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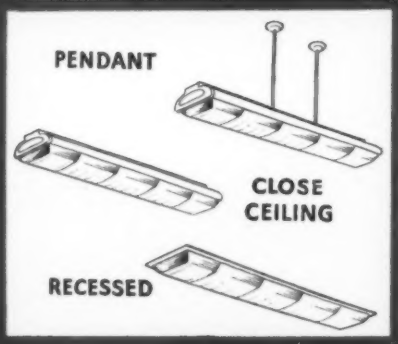

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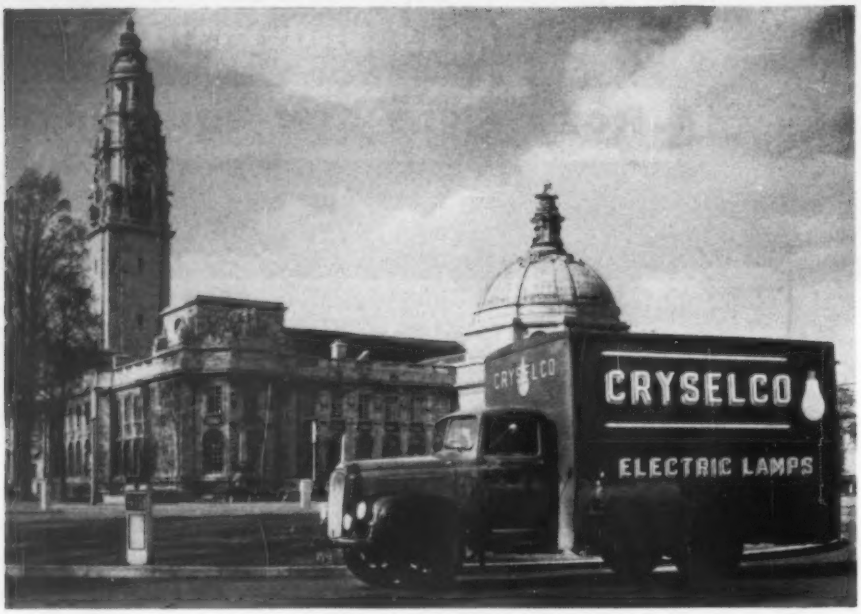

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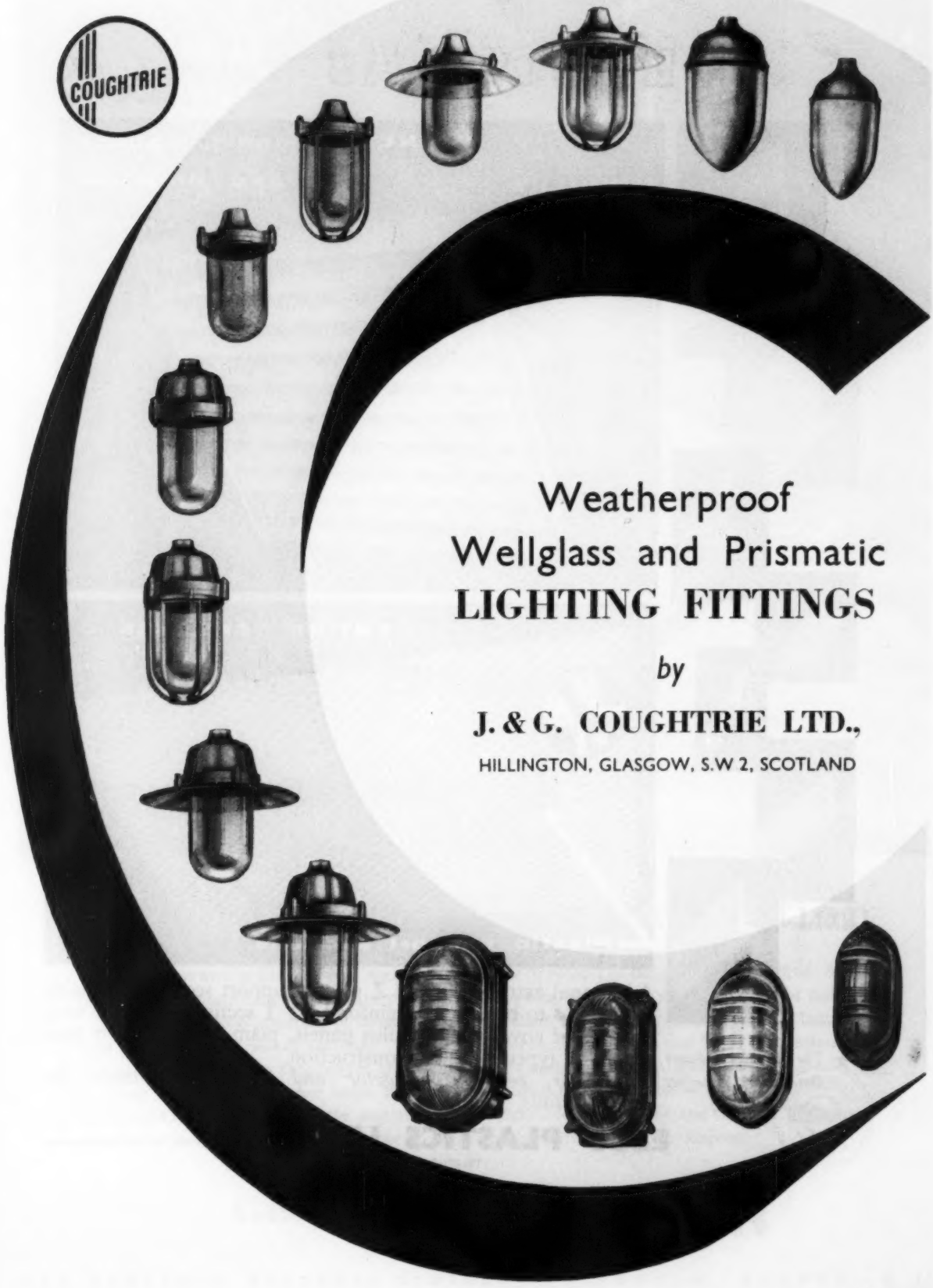

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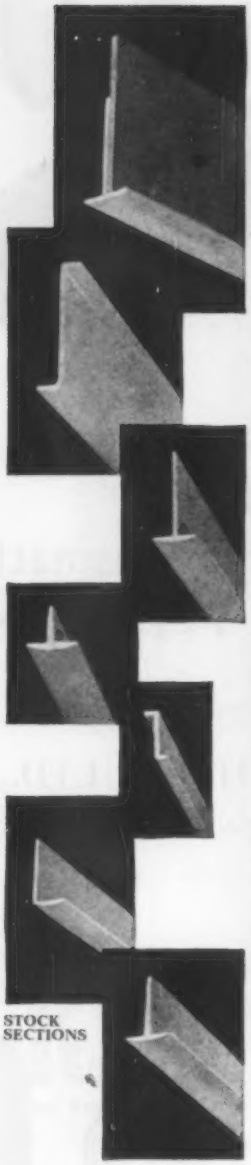

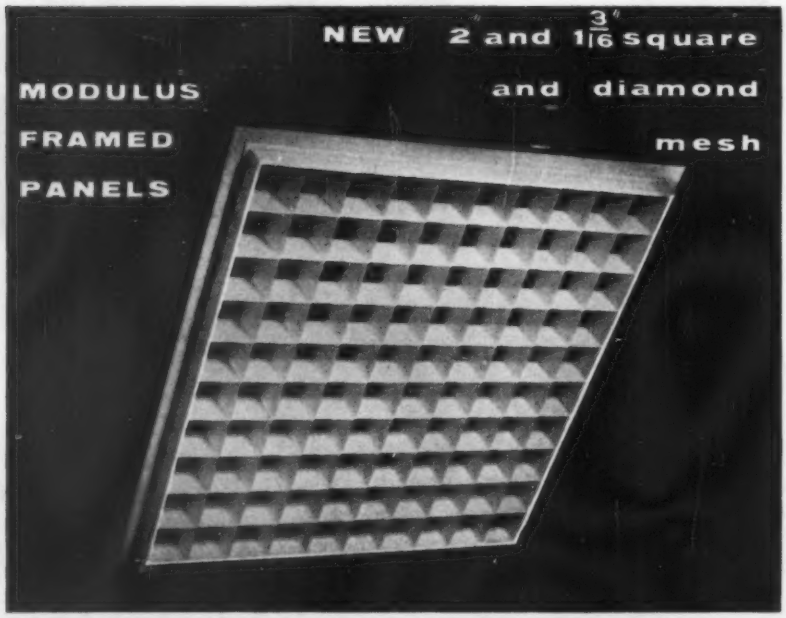

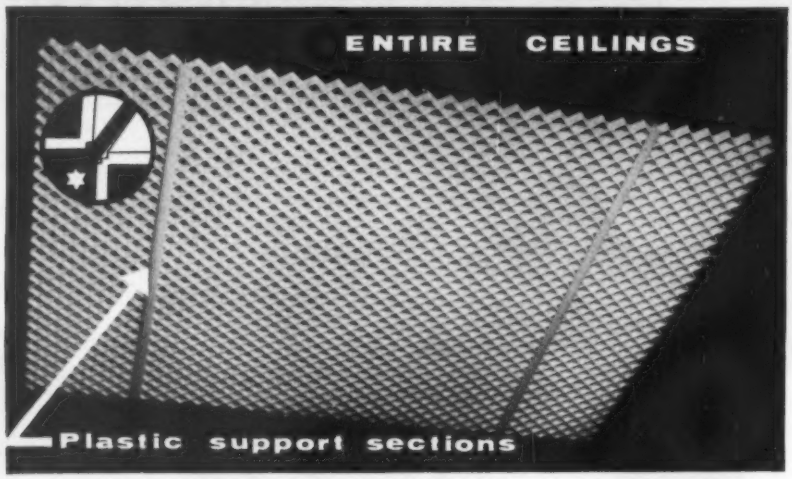

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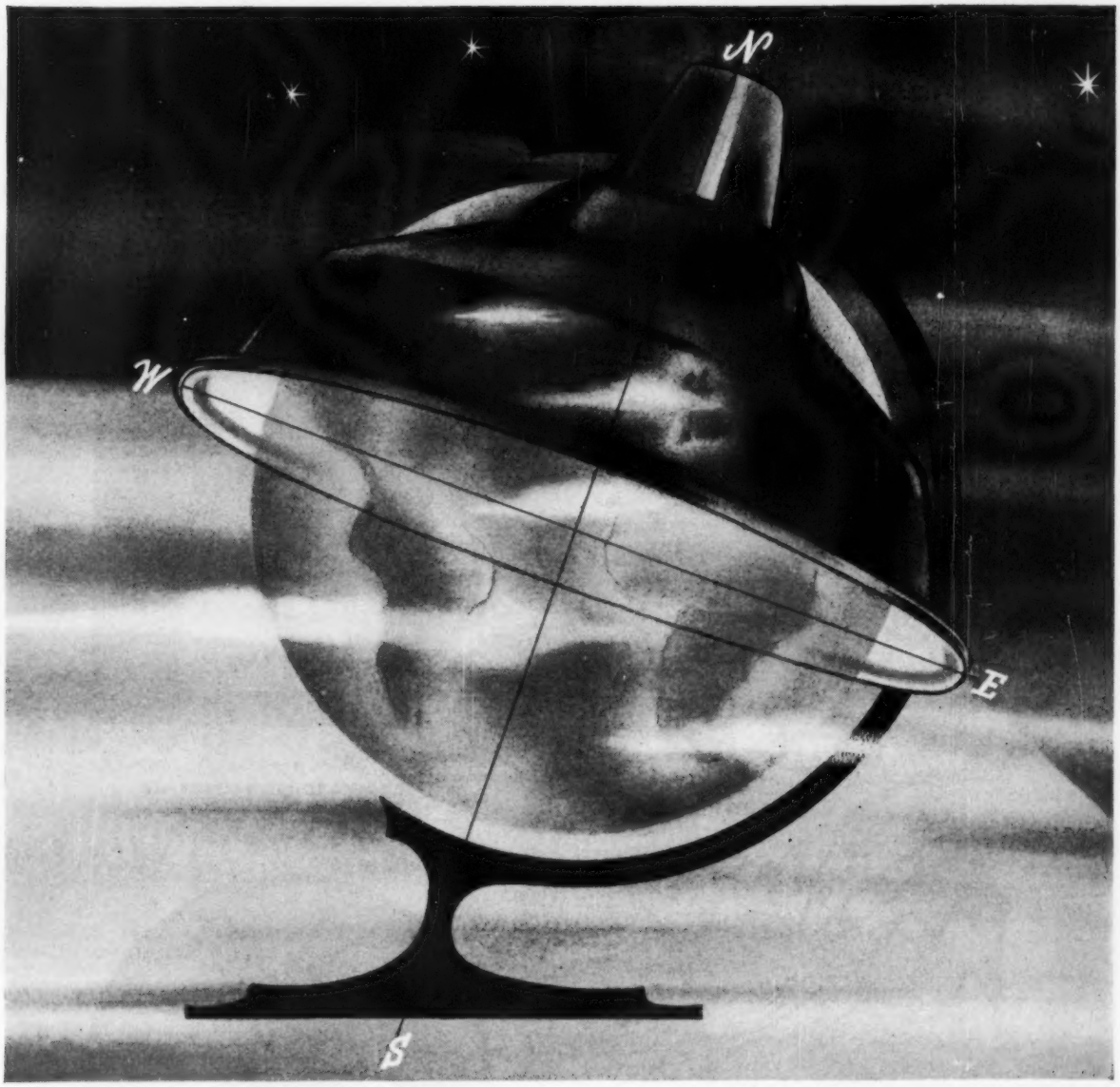

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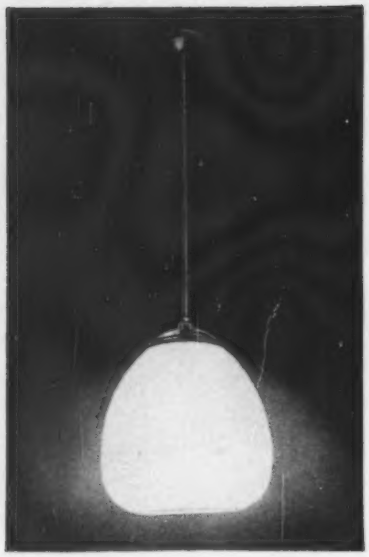

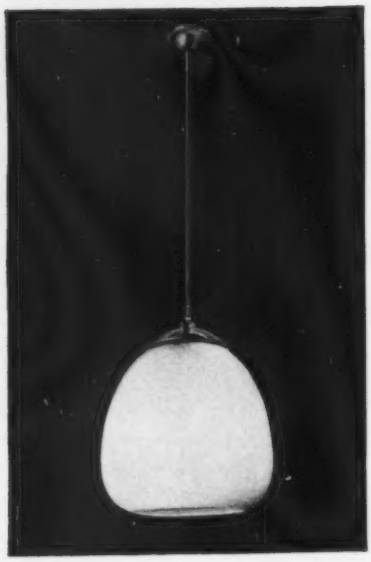

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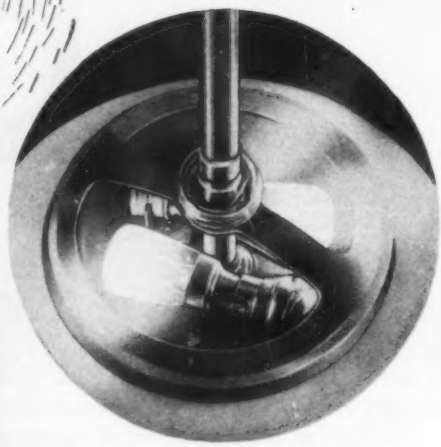

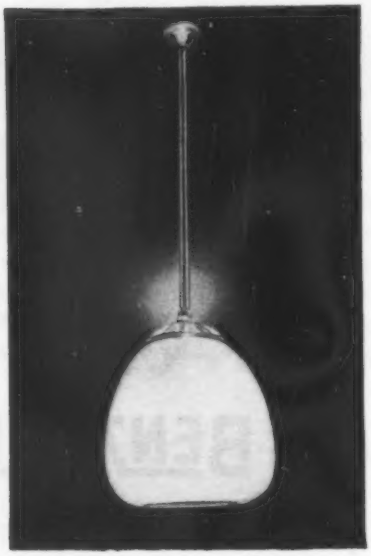

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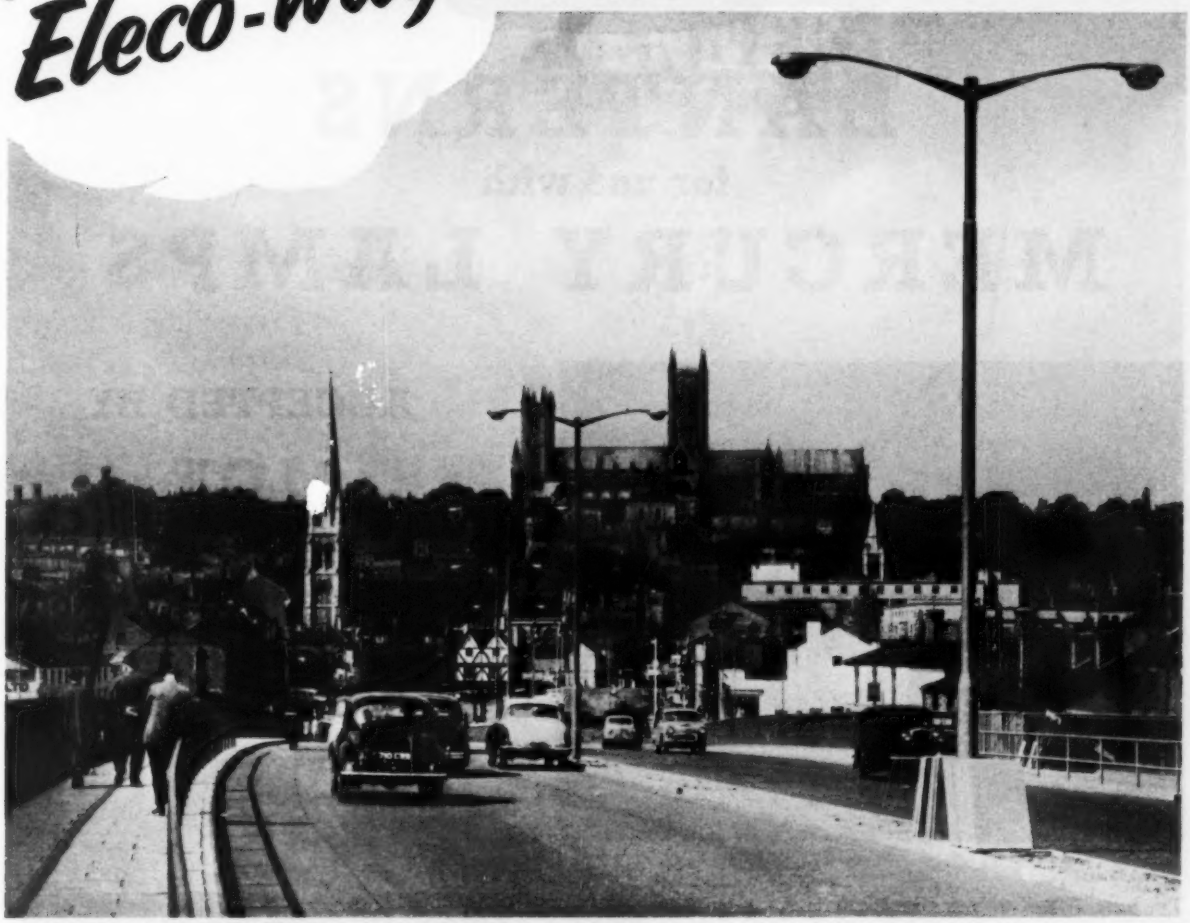

Pelham Bridge, Lincoln. *Officially opened by H.M. The Queen and H.R.H. The Duke of Edinburgh in June, 1958.*
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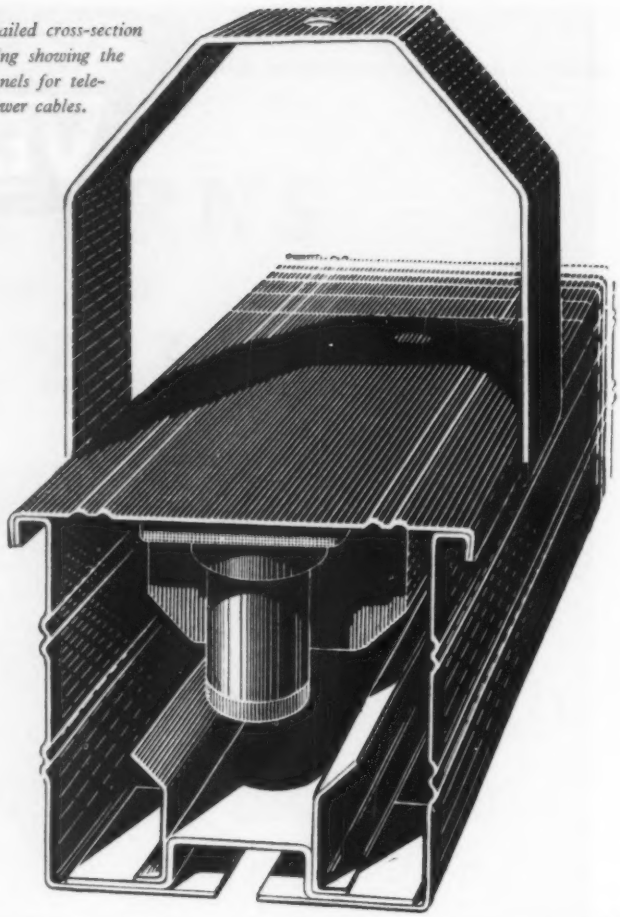

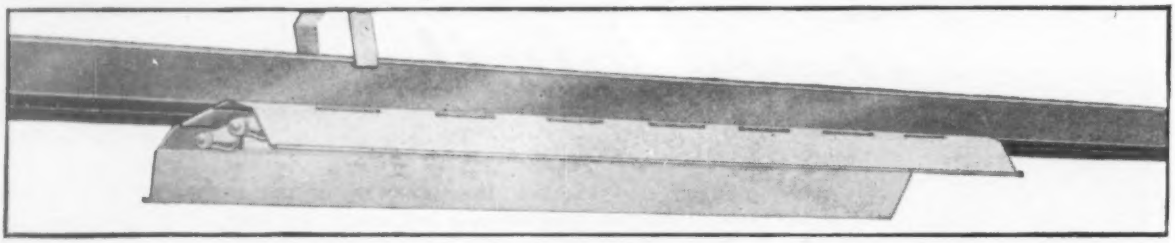

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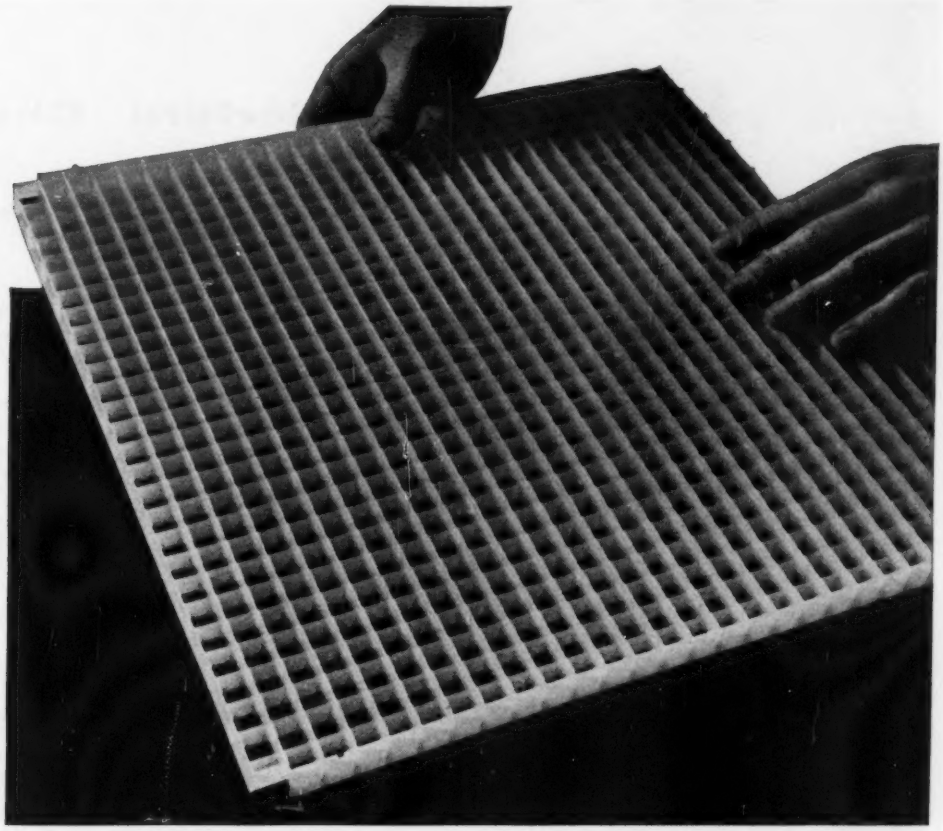

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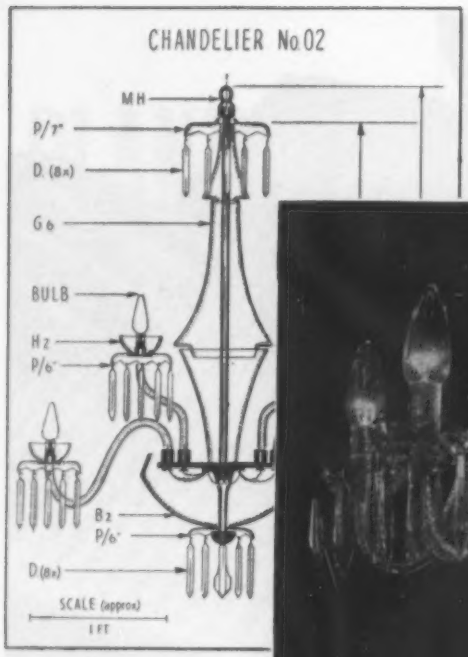

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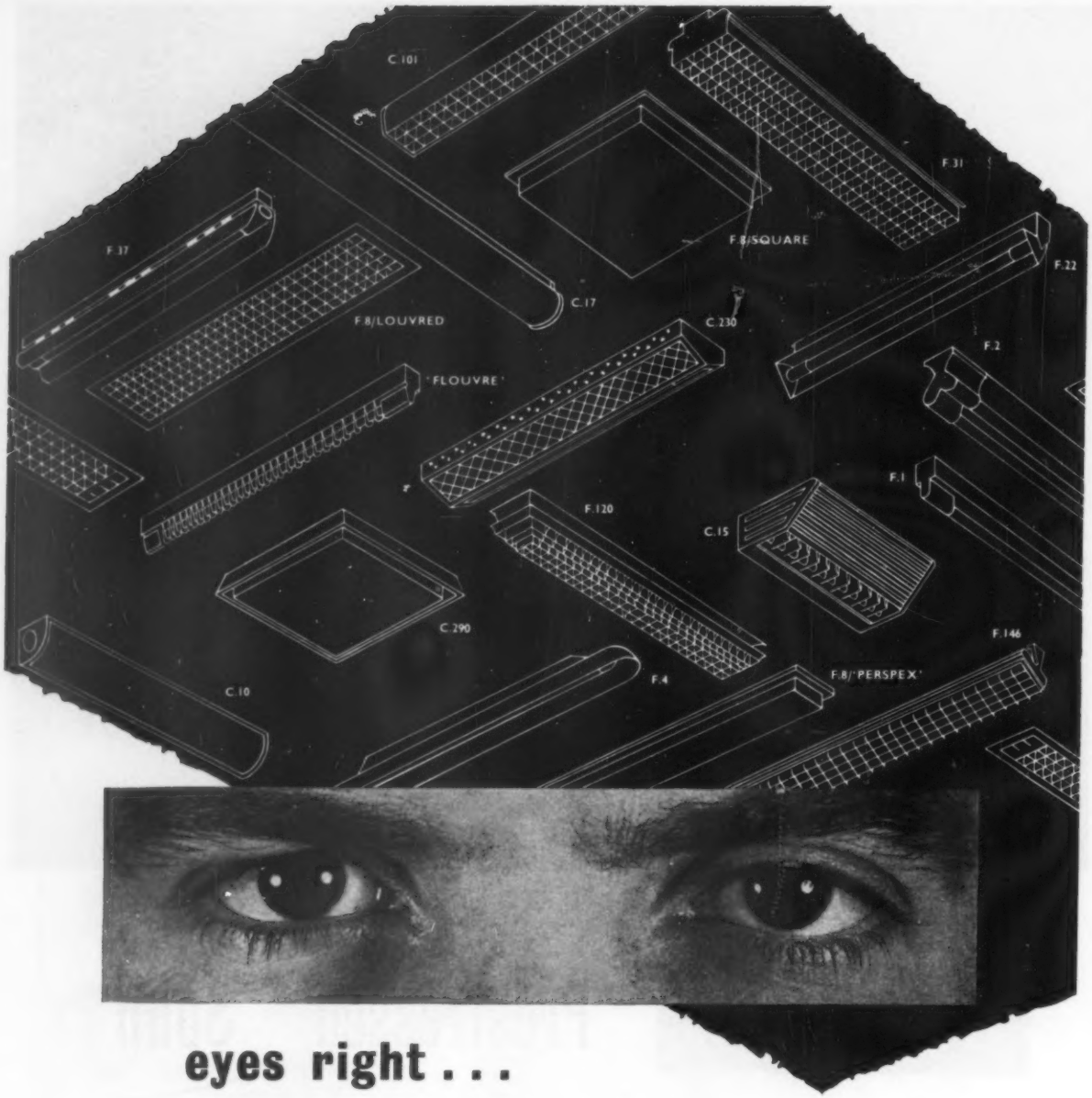

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Light and LIGHTING

Vol. 51. No. 7. July, 1958

Published by The Illuminating Engineering Publishing Co. Ltd. on the 1st of each month at 32, Victoria Street, London, S.W.1. Telephone: ABBey 7553. Subscription rate 30s. per annum.

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Prophecies False and True

LOOKING back to our editorial of this month 50 years ago (for we are now in our Golden Jubilee year) we find two of the matters mentioned involved predictions which it is of interest to recall. The first of these matters was the effects of different man-made illuminants on eyesight and—relating to this—an eminent physician of the time was quoted as saying in 1905, "In two generations half the people will be blind and the other half wearing spectacles, unless something is done to check the injury to the eyes." Well, the time has come to ask whether this gloomy prediction has been fulfilled, and the answer is unequivocally that it has not. The second matter related to a dispute arising from a decision to light a new workhouse and infirmary with electricity instead of gas. This dispute, we commented, emphasized the need of "the illuminating expert, whose coming into being is only a matter of time." Well, this prophecy has been fulfilled; we do now have "illuminating experts." But is their standard of expertise generally high enough, and are they always free to be impartial?

Notes and News

THERE was one disappointing feature about the recent IES Summer Meeting at Eastbourne—that more people weren't there to enjoy it. The attendance was down on last time, though not by so much that the Winter Garden Pavilion didn't look fairly well filled for the technical sessions—and the social functions were probably all the better for the fewer people present. Apart from this it was a memorable meeting; the papers were first class, the social functions thoroughly enjoyable, the Display of equipment the best ever and the Grand Hotel gave first-class service.

These IES affairs run very much to a pattern, but every year some changes are made in an effort to produce an even better show. This time the meeting opened on the Sunday evening with the Display, and Mr. Nash is to be congratulated on the excellent show he made of it in the limited time available. The exhibits themselves were most interesting, but we hope that in future it might be arranged for the Display to figure more prominently in the programme—provided it can still be arranged as an informal display and not be turned into yet another exhibition. As is reported elsewhere in this issue, only a comparative few of the IES Sustaining Members took part at Eastbourne; it is to be hoped that another time all those who have something of interest will be represented.

It would be difficult to pick on any one of the papers as the most outstanding. Dr. Ballin opened with the sort of show we expected—and introduced us to a new sales aid which he called the MMU, or Mind-maker-upper, in other words—effective shop window lighting. The lighting glassware paper was a topical one and as well presented as the subject could be. Overseas speakers to the IES always find a sympathetic audience, but the two speakers at Eastbourne, Esko Paivarinne and Andre Boereboom, needed no sympathy as they both dealt brilliantly and fluently with their subjects. The pre-print of the Baines and Hogg paper was, we gather, incomprehensible to many people, but their presentation was first class. (Let architects talk and they are usually interesting; when they put pen to paper they are so often obscure.) The last paper was Dykes Brown and Stevens on hotel lighting—and who would have expected excerpts from "Genevieve" at an IES meeting, which is how they introduced the paper.

Yet, it was a very good meeting. Those who were present derived some benefit from it. Not all conferences are holidays and it is possible to do useful work in pleasant surroundings and with pleasant people.

NPL Open Days

On the 14th and 15th May the buildings of the National Physical Laboratory were open to visitors, who were shown much of the research, testing and other work in progress at this world-famous institution.

Photometry, it is interesting to note, is now being carried on in two sections of the Laboratory. To a large extent the routine testing of lamps, like that of barometers, thermometers and similar apparatus, is being done in a section called the "Test House." Here a new spherical integrator, 15 feet in diameter, has been built of aluminium alloy, mainly for the measurement of fluorescent tubular lamps. The life-testing of these lamps is carried out in a room on the first floor of the same building.

The original 10-foot sphere remains in the Photometry building, where all the standardization of lamps is still done. This building, too, houses the primary standard of light, and it is here that the colorimetric work continues to be carried out. The apparatus being used by Dr. Stiles for the re-determination of the fundamental colorimetric data was not shown during the Open Days, but Dr. Crawford demonstrated the apparatus with which he is investigating possible methods of specifying the colour-rendering properties of illuminants.

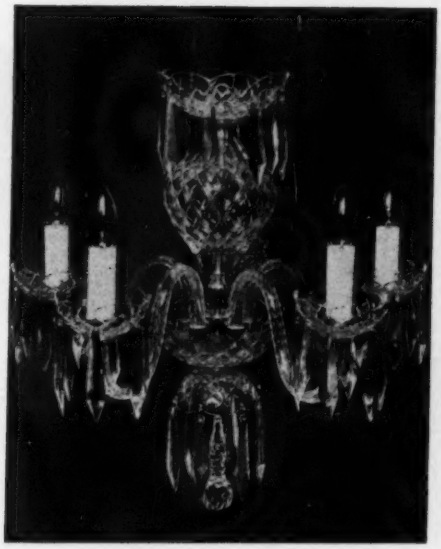
It was interesting to notice in another room the experimental work being done with the ultimate aim of rendering any material standard of light superfluous and making photometry, in fact, a special branch of radiometry. It will be remembered that Mr. G. T. Winch referred to this as a future possibility when he addressed the Illuminating Engineering Society in 1956 (see *Light and Lighting*, Feb., 1956).

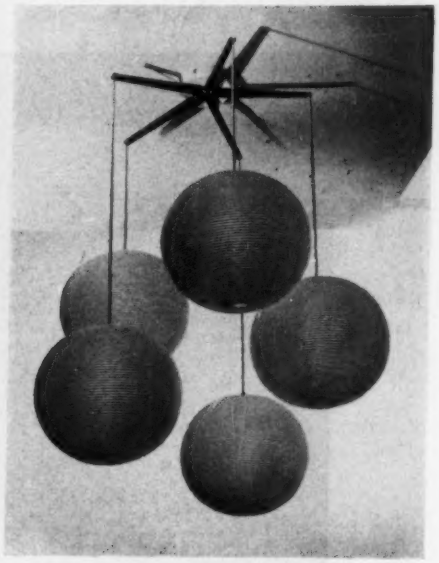
Two Exhibitions

Two exhibitions recently took us to the top end of Regent Street. On one side of the road Liberty's were staging a show of the latest Rotaflex shades, and on the other side was an exhibition of Waterford crystal glass which included one or two chandeliers though these were only a small part of the exhibition which showed the whole range of beautiful products by Waterford Glass Ltd.

One might as well compare chalk and cheese as compare crystal glass chandeliers with Rotaflex shades, and the width of Regent Street is as near together as one is likely to find these two things. They represent the newest of the new and the latest revival of the old.

If we can't compare the products we can, how-





Chandeliers of the traditional and modern types, the latter being one of the Rotaflex variations designed by John and Sylvia Reid.

ever, compare the ways they were shown. The Rotaflex shades were stood or hung around the walls of a section of the showroom, which looked like any other lighting showroom (and included a fair proportion of horrors which we did not expect to see at Liberty's). There was plenty of light around the place—which is more than one can say of the glass exhibition, where, though some of the exhibits were individually lit quite well, we found it difficult to see many of the most interesting pieces. (We did ask for some spot lamps to be switched on, and though this was done for our benefit, we were told that the exhibits looked better in the semi-dark!) The chandeliers weren't even lit.

At both exhibitions we were interested in prices. At the glass show we were as interested in the prices of the drinking vessels as much as the chandeliers, but no prices of anything were available. At the other show we demanded of the chairman of Rotaflex why it was apparently impossible to market a decent floor standard at less than 15 guineas—whereupon he smartly turned us round and showed us one for just over £5. We also saw some attractive wall brackets selling for 19s. 11d. Are we at last getting to the stage where well-designed fittings are as cheap as the junk most people buy?

A.P.L.E. Conference

The Association of Public Lighting Engineers will this year be holding its annual conference at Harrogate from Tuesday, 16th, to Friday, 19th, September.

At the opening session the new President, Mr. Granville Berry, City Engineer and Surveyor of Coventry, will be installed and will deliver his presidential address. Only three papers will be given during the conference, by L. C. Kalff on Municipal Lighting, R. L. Moore and A. W. Christie on Traffic and Safety, and W. Robinson on Street Lighting and the Public. There will also be one session at which a series of short contributions will be made by visitors from overseas. There will be the usual exhibition of street lighting equipment.

London Lights

Our colleague " Lumeritas " this month quotes a woman fashion columnist who does not think very much of the window lighting of London's shops and stores. A London evening newspaper the other day devoted nearly all its leader to the lights of London, which it considered to be one of the finest spectacles that London has to offer—" No wonder tourists flock to London. No wonder so many of them stroll from their hotels in the evening just to take in the scene. The lights of London are magnificent. They make the ancient capital the finest tourist centre in the world." No specific mention is made of shop-window lighting, but it cannot be as bad as the fashion expert would have us believe, for the scene taken in by the tourists must consist largely of shop windows. In our opinion the shops of London are one of its greatest attractions by day and by night. As Dr. Ballin said at Eastbourne, " The lighting of shops and stores has made phenomenal progress in post-war years." There will always be room for improvement and we can rely upon lighting engineers and window display artists to keep up a steady flow of new ideas. But as things stand at present we would say that the lighting of London's shops and shop windows compares more than favourably with that of European capitals we have seen. Long may tourists come to see the shops and other attractions in London.

Widely criticised as an over-dramatisation, the Hall of Tradition of the British Government pavilion at the Brussels Exhibition (architect, Howard Lobb and Partners) is notable for its subtle use of light. The general level of illumination has been kept low to give emphasis to the well-lit exhibits which include, at the end of the hall, a colour transparency of Annigoni's portrait of the Queen.

United States and Vatican pavilions, seen from the steps of the Soviet pavilion.

COMMENT ON BRUSSELS

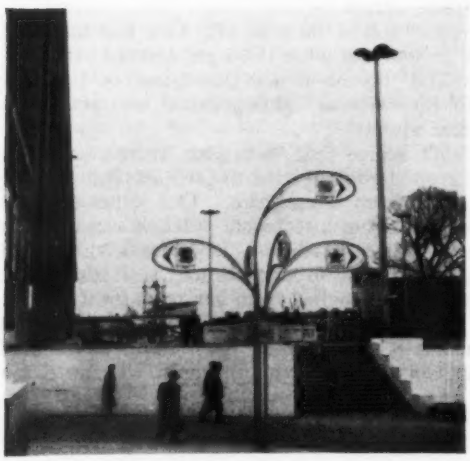
A recorded discussion between Kenneth Last, Colin Penn, A.R.I.B.A., and George Cole, Editor of 'Light and Lighting', on the architecture and lighting of the Brussels International Exhibition.

Chairman : Perhaps we could start by each saying what we consider to be the outstanding feature of the exhibition from the lighting point of view ?

Cole : Apart from the Atomium, I think the view from the reception hall when you first go in is very impressive —provided you go in at night. After that, nothing stands out in my memory more than anything else—just the impression that the right types of lamp—tungsten, fluorescent or cold-cathode—have been used in the right places. Bearing in mind the number of designers involved, I think their efforts knit together very well.

Chairman : Was there any direct co-ordination ?

Cole : I don't think so. The general aim was to light the outdoor areas by spilt light from the pavilions, and this has been achieved successfully without direction from the exhibition organisers.



Directional sign and area-lighting standard with prestressed concrete column —the former condemned, the latter commended in the accompanying discussion.

Penn : I didn't think the outdoor lighting so successful. It seemed rather dark as one walked round, though perhaps this added contrast to the scheme.

Cole : The contrast between the exhibition areas and the gardens was intentional. I thought the lighting of the trees and flower beds was quite adequate.

Penn : I didn't come in at the main entrance at night, but I thought that the lighting of the Atomium was the best thing at the exhibition. There may not be anything new about it, but the way the lights appear to move round the spheres is very effective. The Atomium can hardly be called a work of art, but as an exhibition feature I thought it a great success.

One other thing struck me. There is an avenue of trees trimmed to cylindrical shapes with lamps on the branches. I thought that rather unusual and quite attractive, but I don't know how it will look when the trees are out.

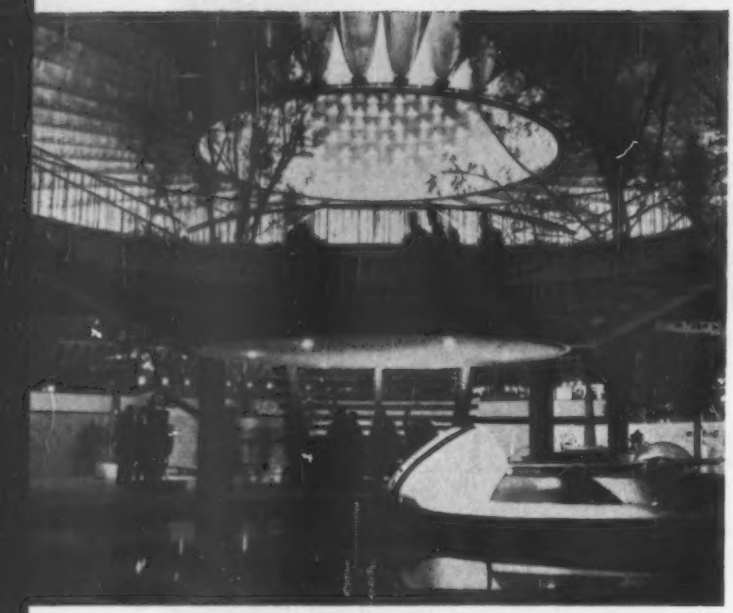
Cole : The trees were lit simply by bare lamps on flex. All they have to do when the trees come out is to move the lamps forward.

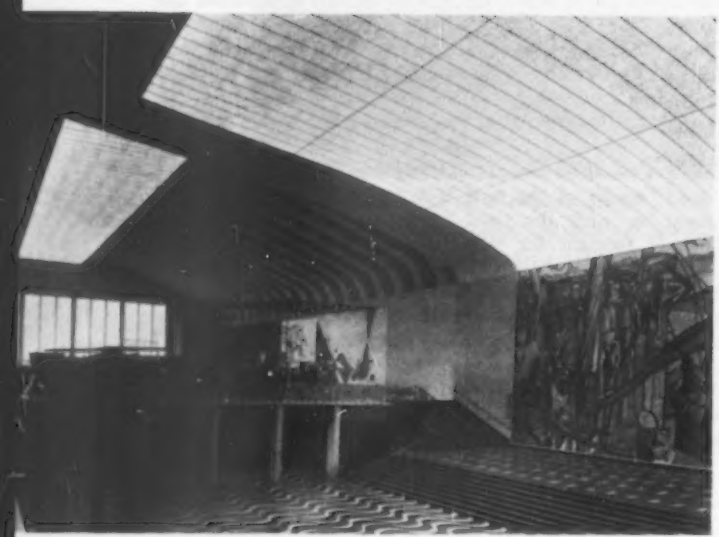
Penn : I thought the lighting of the United States pavilion was very good.

Cole : Yes, their choice of tungsten lamps to light the "gold" mesh of the roof is a good example of what I meant by using the right lamps in the right places.

Last : I thought the whole exhibition delightful, and I was most impressed by all the new "shapes" everywhere. The whole environment was most inspiring to a designer, and to live in that atmosphere for a while was an invigorating experience. The American effort was, I thought, most spectacular. They are trying to show the American way of life, rather than specific technical achievements, and, in doing this, I think they certainly score.

I was impressed in the British Government pavilion





by the subdued lighting and by the way in which the exhibits themselves were illuminated. The fountain display in the Place de Belgique was very good, too, with the illuminated façade of the permanent exhibition buildings in the background.

And then the lighting of the trees and the way the Germans have lit the outdoor areas of their section. Their fittings are like small mushroom-shaped standard lamps. I thought they were very effective, particularly where they are used to light the flower beds.

Chairman : Did any other small items impress you ?

Last : Yes, I was very pleased with the road-lighting fittings used in those areas where there is not enough spilt light from the pavilions. They use an elliptical-shaped formed plastic lantern housing six 40-watt tungsten lamps on a 13-ft. metal standard. I liked them immensely.

Chairman : Was there anything you didn't like ?

Last : I thought the Atomium was ugly. It looked very nice on paper, but I didn't like it when I saw the real thing—though it was interesting to go up to the top.

Cole : One of the things I found disturbing was the difficulty of finding my way into and out of the all-glass pavilions. The German one was very confusing. I could see where I wanted to go, but just couldn't get there ! By contrast, the entrance to the Russian pavilion was obvious and the circulation inside was clearly marked —the symmetry of the pavilion helped, of course.

Chairman : Was there anything else you didn't like ?

Cole : I thought the vast areas of luminous ceiling in some pavilions were too big ; the luminous ceiling must be used with discretion, particularly indoors. The one on the Austrian pavilion is all right—it gives a terrific and attractive blaze of light—but it is not really inside the pavilion. It forms the soffit of the first storey, over the open ground-floor area.

Chairman : Was there anything *you* didn't like, Mr. Penn ? Anything you thought was in bad taste ?

Penn : I doubt if it's possible to be in bad taste in an exhibition. I did think one thing was rather horrible, though, and that was the directional signs. They didn't seem to give the information very clearly and they didn't look very nice, either.

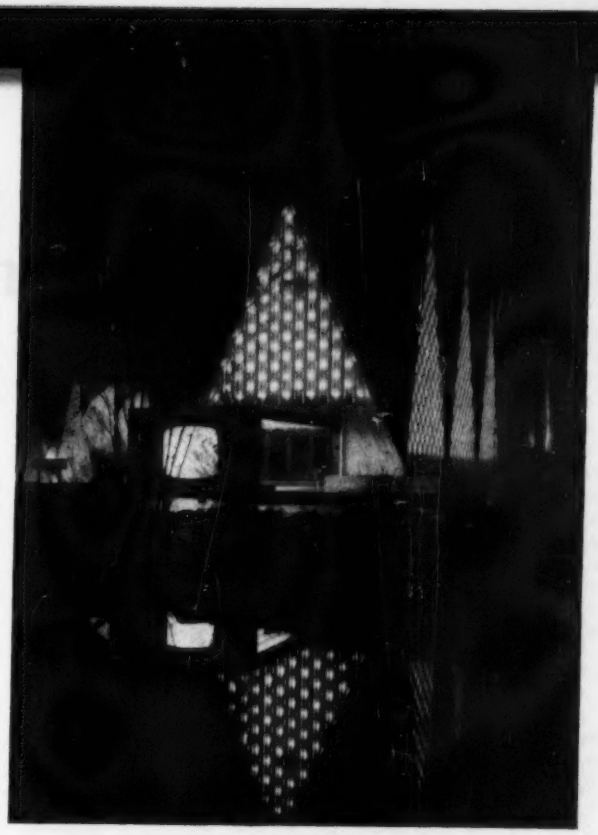
Cole : I couldn't follow them at all. One had to buy a guide book to find out what the signs meant !

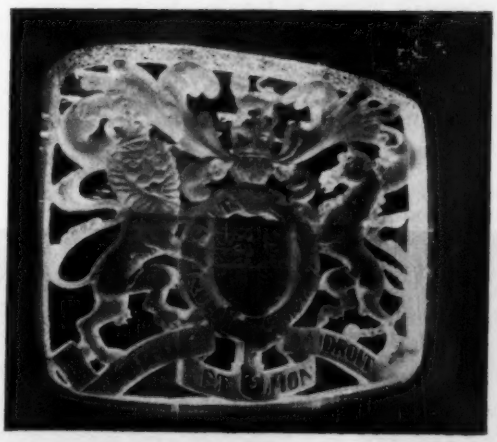
Chairman : Did anyone notice that some of the projectors used for external lighting shone into your eyes as you walked about ?

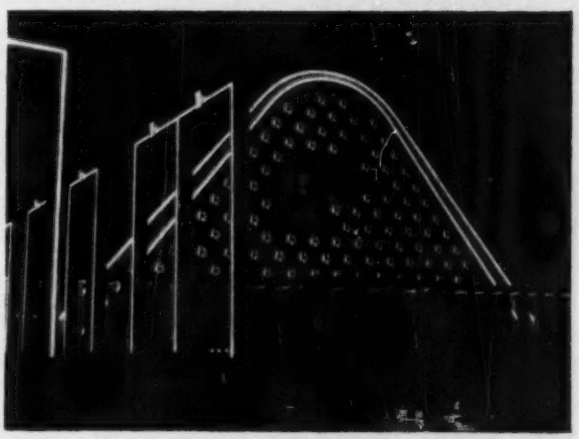
Cole : I didn't notice that, but when there's so much lighting all around you're bound to get *some* light shining into your eyes from somewhere. One other thing I thought was bad, from a technical point of view, was in the Czechoslovakian pavilion. In general, this is an excellent pavilion, but in one section of it they have reflector spotlamps dangling from about 20 ft. of flex.

Chairman : There was one fault I noticed in several of the cinemas—in the one in the Mining Pavilion of the Belgian Congo section, for example. There is no

Top : 'using the right lamps in the right places' —inside the United States pavilion. Centre : 'a terrific and attractive blaze of light'— the Austrian pavilion at night. Bottom : 'vast areas of luminous ceiling'—entrance hall of Belgian Congo pavilion.







Top: British Government pavilion at night, with reflection in lake. Centre: close-up of Royal Coat of Arms carved in 'Perspex' and edge-lit. Bottom: 'even more striking than the Atomium'—the new façade of the main reception hall of the exhibition.

gradation of light as you go in, so that when you enter you cannot find your way to your seat and when you leave you are blinded by the sunlight.

Now, perhaps, we could turn to the buildings themselves?

Last: There are some countries that have imposing buildings and not a great deal inside—the United States and Yugoslav pavilions are fine examples of that approach. The Russians have an imposing building *and* they have put a lot of exhibits into it. *Their* building is, basically, a shell to cover the exhibits, while the British seem to have concentrated almost entirely on the exhibits.

Chairman: Is the British approach of concentrating on the exhibits unique?

Last: Well, in the Electrical pavilion of the Belgian section there is no general lighting and the displays are individually lit. And then there is the entrance hall of the International section, where there is a vast domed hall something like a planetarium. It is quite dark inside, especially as one comes in from the sunshine, and on the end wall is a cyclorama on to which is projected a map of the world, with symbolic figures superimposed on it.

Cole: Could I return for a moment to my *bête noire*—the all-glass pavilion? In several of the pavilions back projection of films is used. In the British pavilion I thought it was perfect. There is a series of about 20 screens on which short films illustrating the British way of life are shown simultaneously. Lots of other countries are using back projection—the Americans in particular—but many of the films are very poor and, in the all-glass pavilions, the screens are badly placed. They either face the wall so that you see reflections of the exterior on the screen, or *against* the wall, so that you can't see the picture at all because your eyes cannot adapt properly.

Another problem is ventilation. I don't know what precautions have been taken, but in a heat wave I should think these pavilions will become unbearable.

Last: No one has mentioned the Finnish pavilion. The Finns are considered to be leaders in the world of design and they had a lot of interesting things to show—cutlery, jewellery, and so on. They had some interesting lighting fittings, too, using a combination of coloured and opal glass.

Another thing that impressed me was the area lighting in parts of the Belgian section. There are a number of prestressed concrete columns, nearly 100 ft. high, with four fittings radiating from the top, each housing three 1,000-watt mercury lamps and one 1,000-watt tungsten lamp.

Chairman: Would anyone care to comment on the use of colour?

Last: There is not a great deal of coloured lighting. With so much "going on" all the time, there really isn't much need for it.

Penn: I thought the lighting of the façades of the British Government pavilion was rather effective. The thousands of blue, green and white pygmy lamps housed

in recesses in the sides of the pyramids form an attractive pattern of colour.

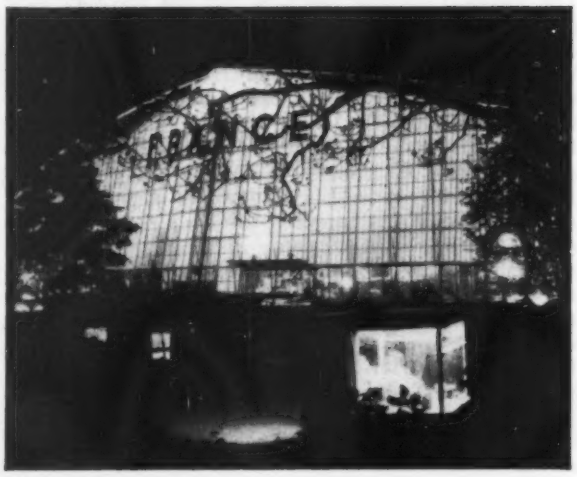
Cole: The new façade of the main entrance building is in colour, too. It is painted blue and is lit by continuous lines of cold-cathode tubing round the parabolic arch and by lamps concealed by the exhibition emblems which are fixed to it. To my mind this façade is more striking even than the Atomium. You can see it from the centre of Brussels. There is colour in the louvred ceiling of the Paris pavilion and, of course, in the lighting of the water ladder.

Chairman: Would anyone dare compare the lighting at the exhibition with the best of current practice here in Britain?

Penn: Well, I didn't see anything that struck me as particularly new, but, I think, on the whole, the lighting is very good. It does its job of enhancing the architecture very well. But to compare it with anything in England . . . there is nothing in England on a comparable scale.

Cole: I suppose the last thing we have to compare it with is the South Bank exhibition, and there is no doubt that the lighting at Brussels is streets ahead of what we had on the South Bank in 1951.

Chairman: And, coming from a South Bank enthusiast, that is praise indeed!



Top: the well-emphasised entrance to the Soviet pavilion. Centre: part of the French pavilion—finished at last. Bottom: the Atomium at night (with the Petroleum pavilion in the foreground)—'as an exhibition feature . . . a great success.'

IES Summer Meeting

Eastbourne, May 11—14

This, the sixth Summer Meeting of the Illuminating Engineering Society, was held in Eastbourne from May 11 to 14, although the technical sessions did not begin until the morning of Monday, the 12th. The reason for this departure from previous practice was, we understand, to enable those taking part in the meeting to travel to Eastbourne on the Sunday and so avoid the loss of a working day.

On the Sunday evening many members and visitors took the opportunity of inspecting the display of lighting equipment which had been arranged in the ballroom of the Grand Hotel and was opened at 9 p.m. by Dr. J. W. T. Walsh, President of the International Commission on Illumination. This display, which seemed to be of an even higher standard than that of two years ago at Harrogate, had been arranged by Mr. A. H. Nash. A description of the exhibits will be found elsewhere in this issue.

On Monday morning at 10 o'clock there was a large gathering of members and visitors in the Winter Garden for the official opening by the Mayor of Eastbourne, who recalled that when, some twenty years ago, he had first become associated with public lighting on a committee of the Corporation, the discharge lamp was in an early stage of its development. He congratulated the Society on its work for the promotion of better lighting, which, he said, was of the greatest benefit to everyone. Concluding with a sincere welcome to Eastbourne, he then declared the Summer Meeting open.

The President, Mr. E. B. Sawyer, expressed the thanks of the Society for the welcome it had received and the help which had been so ungrudgingly given by officers of the Corporation and others during the period of preparation for the meeting. He welcomed a number of members and visitors from overseas and said how very much the Society appreciated their presence on occasions such as this.

Lamps and Fittings since 1945

After a brief interval, the first technical session was held under the chairmanship of Mr. C. C. Smith, President-elect of the Society, and Dr. H. H. Ballin, of Atlas Lighting Ltd., presented a summary of his paper "Lighting Trends since 1945: A Survey of Industrial, Office and Shop Lighting," in which he surveyed broadly the major developments of the last twelve years or so in lighting equipment and the tendencies noticeable in general lighting design.

The advent of the fluorescent lamp had been followed by continuous increases in useful life and in efficiency, and these had been accompanied by drastic reductions in the cost of the lamp itself. The consequent phenomenal fall in the price of the lumen-hour had been one of the main reasons for the achievement of higher standards of lighting. The other developments to be recorded were the introduction of the colour-corrected mercury lamp and of the internally mirrored reflector lamp, both of which were being widely used, whereas two other introductions, the "very high output" fluorescent lamp and the electroluminescent panel, showed no signs of affecting general lighting practice.

In fittings the chief development, said Dr. Ballin, had been the replacement of steel by plastics, particularly methyl methacrylate for commercial fittings and p.v.c. for special purposes. The use of opal acrylic diffusers or egg-crate louvers, giving a general light distribution, was widely favoured for commercial fluorescent fittings. The use of starter switches had decreased, especially where maintenance was difficult, and resistance circuits, often with ballast lamps, were sometimes found advantageous, particularly in shops where the partial colour correction was an asset.

Industrial Lighting

Turning to general lighting practice, Dr. Ballin said that illumination levels in industry had risen considerably since the war. He illustrated this by comparing a number of values of illumination recommended for certain factory processes in the 1945 and the 1955 editions of the IES Code. There was every indication, he said, that the higher levels were now widely adopted by factory managements and he attributed this partly to the present-day emphasis on productivity and partly to the need for providing attractive working conditions, especially where the employees were women. A matter of great importance to-day in factory lighting was the need for flexibility, and this had been met by the development of lighting trunking which solved a number of other problems as well.

The integration of the lighting with the structure of a building had been made possible in a number of factories where new methods of construction were employed and some interesting examples were described by the author. For high-bay installations the ordinary HPMV lamp was being superseded by the colour-corrected mercury lamp or by a blended system.

Progress in office lighting, said Dr. Ballin, had been slower, but the increasing mechanisation of office work had made adequate lighting essential. The lower ceiling heights common in new buildings favoured the use of tubular fluorescent lamps in ceiling-mounted or recessed fittings. In modern offices flexibility was again the aim. Shallow trunking systems had been designed to carry the electrical services, and fittings suspended from this trunking could be removed to other positions without the need for rewiring.

Shop Lighting

The progress made since the war in the lighting of shops and stores was described by Dr. Ballin as "phenomenal." It had taken place in four stages, *viz.* (i) fluorescent lighting only under fuel restrictions, (ii) fluorescent lighting after the removal of restrictions, (iii) a reaction against fluorescent lighting and a return to the tungsten lamp and finally (iv) the use of fluorescent lamps and tungsten lamps in combination.

Shops of different kinds needed different treatments. First there were the multiple stores and supermarkets designed to tempt the passer-by to enter and purchase on impulse. In the early nineteen-fifties 40 lm/ft^2 was exceptional, but now there were examples of 60 and even 80 lm/ft^2.

Individual shops varied greatly in their requirements. The shop which specialised in one class of goods offered the greatest scope for original design and shoe shops had been prominent in the successful use of lighting systems integrated in the design of the interior.

Integration and flexibility were the subjects treated by the author in the next section of his paper and he gave some interesting examples, including two in which dark ceilings had been used deliberately to concentrate attention on the sales area.

In shop-window lighting, illumination levels had increased to values reckoned in hundreds of lumens per square foot, but nevertheless the main concern had been with quality rather than quantity; matters such as the improvement of modelling or the heightening of dramatic effect were receiving increasing attention.

Concluding his paper with a section entitled "The Challenge of the Future," Dr. Ballin said that the architect and the interior designer must be encouraged in their growing appreciation of the vital part that lighting could play and of the great contribution that the experienced and imaginative lighting engineer could make.

Dr. Ballin illustrated some of the remarks in his paper regarding shop-window lighting by means of a display window on the stage and at the end of his presentation he gave his audience a peep into the future. He showed them what he fancifully termed the MMU or "Mind-Maker-Upper" in which the lighting of the shop window, by means of successive changes of effect, convinced the hesitant passer-by that now was the time to purchase some alluring article of feminine attire.

What is an Illumitect ?

The discussion was opened by Mr. John Reid, whom the chairman referred to as an "illumitect." He said that lighting had travelled a long way since 1945 and lighting engineers had learnt that there was no unique solution of any given lighting problem. The standard of interior lighting at present was deplorably low: there was good equipment available but no interiors in which to employ it, for, until 1954, building had been cramped by shortages and makeshift. Soon, however, some really exciting buildings would be coming along and in the near future architects would be presenting the lighting engineer with much more exacting demands.

Mr. L. C. Rettig expressed the opinion that the present acceptance of higher levels of illumination in this country was in no small measure due to American influence and Dr. Ballin, in his reply subsequently, agreed that this might well be so. Mr. Rettig showed a slide of high level lighting (80 lm/ft^2) with cross-louvering.

Mr. H. Olson, referring to the lighting of the "specialty" shop, said that this had been influenced first from Scandinavia, then from Italy and still later from Japan. The economic aspect of the matter was most important and he felt that some of the new materials being introduced would probably allow the designer still greater scope.

Mr. W. Imrie-Smith urged caution in the use of integrated lighting, at any rate as far as industrial installations were concerned. The lighting engineer had to ensure that there was adequate light for the work and the emphasis should be on this rather than on integration. He felt that the background lighting might well be provided by an integrated scheme, with a more localised system providing the high illumination necessary on the work itself.

Mr. S. Anderson asked the author for clarification of Fig. 1 which showed the number of lumen-hours obtainable for a penny to be fifteen times as great in 1957 as in 1943, and Dr. J. W. T. Walsh, pointing out that these figures referred only to the cost of the lamp, not to that of the power consumed, thought the legend to the figure ("Cost of fluorescent lighting") rather misleading.

Mr. J. B. Harris agreed that the colour-corrected mercury lamp was a very useful source of light for many purposes; trials were now being made of installations in which this lamp was blended with tungsten. Drawing offices presented a very difficult lighting problem and he had come to the conclusion that the best solution was to provide general lighting by fluorescent and to supplement this with local lighting by tungsten, under the control of the draughtsman.

Mr. F. L. Cator, of the IES Transvaal Centre, said that the two lamps most extensively used in South Africa were the 8 ft. 75-watt slimline and the 8 ft. 120-watt VHO (very high output) fluorescent lamp. Mr. A. Wilcock referred to the increasing use of reflector lamps and to a more general recognition of the fact that windows could no longer be expected to provide all the illumination required in a room. Mr. R. Boissevain thought that fittings for tungsten lamps had shown much greater development than those for fluorescent lamps and he attributed this to the greater scope which the small source offered to the designer.

In his reply Dr. Ballin urged that the engineer should appreciate that lighting was an art. He replied to criticism of his reference to the increase shown in Code values between 1945 and 1955 by saying that the point to which he wanted to draw attention was the *acceptance* by industrialists of the

Left: The President with some of the vice-presidents and members of the Summer Meeting Committee. Left to right: A. H. Young, N. Boydell, C. C. Smith, the President, H. G. Campbell, W. Robinson, F. X. Algar, and A. H. Nash.

Above: Dr. J. W. T. Walsh opening the Display.

higher values recommended to-day. He said that in the VHO lamp there had to be some sacrifice of both efficiency and life. For industrial and shop lighting, he thought the developments were greater in fluorescent than in tungsten lighting.

Glassmaking

On Monday afternoon, under the chairmanship of Mr. Guy Campbell, a paper on the "Design and Production of Glassware for Lighting," by D. Shellshear of Troughton and Young (Lighting) Ltd., and C. D. Cartwright of Stevens and Williams, Ltd., was read and discussed. In an interesting survey of the history of glassmaking, which went back many centuries before the Christian era, the authors said that the use of blown glass in lighting apparatus began when a glass chimney was used to protect the flame and assist combustion in the Argand lamp of 1784. The use of lead, or crystal, glass for chandeliers was widespread at an earlier date, but these largely depended for their effect on the sparkle obtained with candles; after the introduction of the gas flame and mantle they gradually went out of fashion. About the end of the nineteenth century solid opal glass bowls began to appear. Three-ply or cased opal glassware was extensively imported before the 1914-18 war but after that its manufacture was taken up actively in this country.

The authors showed how the traditional methods employed in glass making were gradually modified and adapted to new conditions. They described the process of blowing a lipless sphere, from the first "gather" of a small ball of glass at the end of the blowing iron, to the shaping of the final hollow sphere in the finishing mould and its travel through the "lehr" or annealing oven. They mentioned the ways in which it was possible to produce such decorative effects as "flakestone," or the incorporation in the glass of spots or veins of colour, and emphasized how greatly the whole process depended on the skill of the craftsman. Decoration of the glass could be by mechanical treatment, such as cutting or sandblasting, or by the application of ceramic enamels to the surface of the glass and their subsequent firing to produce a permanent pattern.

The first part of the paper, dealing with manufacture, ended with a short section on packing and transport, which the authors described as one of the most serious problems facing the lighting glassware industry in this country.

Design

The second half of the paper was concerned with progress in the design of fittings made of blown glassware. Pointing out that there was little scope for designers before 1920, since practically all lighting glassware was then imported from abroad, they mentioned the various stages in the initial development of box-shaped and spherical designs and, later, the addition of the familiar "halo" which marked the beginning of a departure from pure functionalism.

In the opinion of the authors it was the post-war period that produced the most interesting developments in the history of lighting. Quite early a demand for open base fittings resulted in the now familiar "acorn" shape. In this country good design was fostered by such bodies as the Council of Industrial Design and the Society of Industrial Artists, but development was held back by the imposition of severe restrictions on the use of brass and copper during 1951 and 1952. About 1953 blown glass appeared in more interesting shapes, though generally the open base was retained. The incorporation of these better designs in multi-light fittings led to a vast improvement in the types used for the lighting of important buildings. After 1953 still other new designs appeared and glasses tended to become smaller.

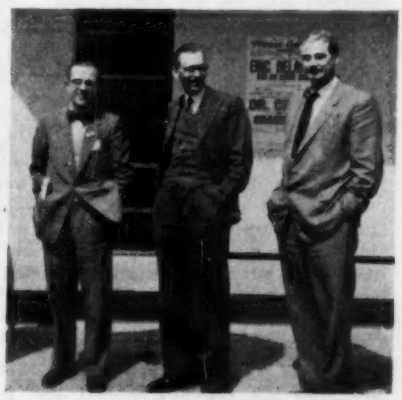
Overseas some outstanding work was done by a designer in Sweden who produced a range of long shapes instead of the bulbous ones hitherto almost universal. These glasses, which had a satin etch finish, were imported in 1954 and proved to be very popular. In Germany the lighting industry, being much larger than in this country, could afford to design and market fittings of high aesthetic quality and the authors showed slides of a number of these, including a specimen of the double glass fitting in which diffusion was provided by the inner glass while the outer one, of clear glass, carried a delicate sandblasted pattern.

In the United States, too, there had been notable developments, in particular the production of small quantities of exclusive glass shapes requiring techniques which, although well known in the blown glass industry, were not economic for mass production.

The authors concluded their paper by showing slides of a number of recent British designs. As to the future, they said that glass would never be superseded; present trends would probably lead to the use of new mould techniques and applied decoration. Their final words were an appeal to the blown glass industry in this country to intensify its efforts to encourage good design, with benefit both to the public and to the manufacturer.

As part of the presentation of the paper, Mr. Cartwright demonstrated to the audience how the blowing iron was used to produce an enclosed fitting. He also showed a colour film, made in a glassworks, of a glassblower carrying out the various processes described in the paper.

The discussion was opened by an architect, Mr. B. Davies, who criticised some of the principles laid down by the authors



Left: H. Gasowski (Poland) and R. Bury. Centre: John and Sylvia Reid, Dr. and Mrs. Ballin, and C. C. Smith. Right: D. Shellshear, C. J. Misselbrook and C. D. Cartwright.

for the guidance of fittings designers. He said that to tone down the brilliance of the illuminant was to kill all sparkle and lustre, while softening the shadows might or might not be desirabe according to circumstances. In many fittings to-day little attempt was made to direct the light to where it was most needed and usually there was a great deal of light where it was not needed at all. There should be an element of interest in the lighting itself and he felt that there was room for a greater use of clear glassware in the design of fittings.

Mr. Derek Phillips remarked on the degree to which hand work was involved in the production of blown glassware and inquired whether there was more mechanisation in other countries, while Mr. A. H. Nash asked why sandblasting was sometimes used in place of a satin etch.

Another architect, Mr. A. Pott, complained that the whole subject of design had been treated in a very limited way. The designer seemed to confine his attention to shape and to added decoration, paying no attention whatever to such matters as surface brightness or light distribution.

The first author to reply was Mr. Shellshear, who said that toning down the brightness of the illuminant contributed towards the avoidance of glare. He agreed with some speakers that the British glass industry had lagged behind its foreign competitors at first, but the situation had rapidly improved and was still improving. Mr. Cartwright thought that Mr. Davies was really asking for cut glass which, though it could certainly be produced, was expensive.

Lighting in Finland

Tuesday was international day. It has always been the custom of the Society to include in the programme of its Summer Meeting one paper by an author from overseas, but on this occasion there were two such papers; one, a description of lighting practice in Finland, the other dealing with the lighting of the Brussels International Exhibition.

First Mr. E. Päivärinne, of the Finnish Lighting Society (Valosto), spoke about lighting developments in that country. Until about eleven years ago, he said, illumination values were low. Filament lamps in general diffusing fittings were used to give an illumination over the working area of some 2 to 4 lm/ft^2, supplemented by local lighting where necessary. Any increase in current consumption was strongly opposed and attempts were often made to improve matters by making most of the room surfaces almost white.

With the introduction of the fluorescent lamp, which took place at about the same time as the foundation of the Lighting Society, the situation rapidly improved. General illumination levels in interiors rose steadily and to-day values of 15 to 30 lm/ft^2 were not exceptional. In outdoor lighting, however, progress was less marked. Discharge lamps were more or less confined to the main streets of large towns, but the great increase in the volume of motor traffic would doubtless bring about a quicker development in the immediate future.

The lamp industry in Finland was comparatively young, but production had trebled since 1939, while the average watt rating had increased by 10 per cent. in the last five years. The 40-watt reflector lamp was very popular for domestic use in small local fittings. The production of fluorescent lamps began in 1947 and now lamps were available in seven different tones of white and in wattages ranging from 15 to 80. Colour-corrected mercury lamps were now being manufactured, mainly for street lighting purposes.

School Lighting

Turning to lighting practice in Finland, Mr. Päivärinne said that the Lighting Society had paid more attention to the lighting of schools than to such matters as shop lighting, which it was felt might well be left to develop as a result of commercial competition. The first fluorescent fittings in schools were of the general diffusing type, but about five years ago the direct-indirect louvered pendant fitting came into common use. Then there was a demand for recessed fittings and a 40-watt single lamp fitting had been designed, having in mind the avoidance of reflected glare. The reflector was of specular aluminium and gave an asymmetrical distribution, the greater part of the light being emitted between 10 deg. backward and 60 deg. forward from the vertical plane. There were no louvers and shadow formation was strong enough to give good modelling, but was not disturbing.

The general development of office lighting followed similar lines; most offices were now fitted with direct-indirect twin 40-watt louvered fittings with aluminium side reflectors. Luminous ceilings were seldom used. For the general lighting of factories twin 40-watt louvered fittings or 80-watt lamps in multi-light fittings were frequently employed, while for factories with high ceilings the colour-corrected lamp was gaining favour.

The author devoted one section of his paper to the problems connected with recessed fittings which, clearly, are very popular in Finland. He said that in order to facilitate the use of such fittings, the Lighting Society, in collaboration with the associations of architects and of fittings makers, had standardised the dimensions of ceiling openings. To minimise fire risks the Finnish Electrical Inspectorate had laid down certain constructional requirements, including minimum dimensions for the fittings.

Another problem was glare, due to excessive contrast between the fittings and the surrounding ceiling, and specially shaped reflectors had been designed with the object of keeping the brightness low in those directions from which the fittings were normally seen. In many cases it had been possible to avoid the use of louvers which caused a reduction in efficiency and were difficult to keep clean.

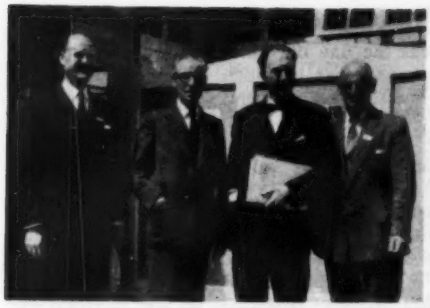
In street lighting the colour-corrected mercury lamp was coming into use in the main streets of the larger towns. It was generally mounted horizontally in an anodised aluminium cut-off reflector. Sodium lighting was used on main roads leading into towns and was much liked by drivers.

Among special lighting installations Mr. Päivärinne mentioned that of the chapel in the Students' Village of Helsinki Technical University and the auditorium lighting in the so-called "Minor Stage" of the National Theatre. He also described the ward lighting in the General Hospital of Middle Finland where a bed-fitting of special design was used. At the end of his paper he showed slides of a number of modern fittings for filament lamps, some of them distinctly novel, such as that in which 30 discs of "snowflake" shape were suspended above an indirect reflector of polished brass.

Artistry and Aluminium

The chairman, Mr. J. G. Holmes, after congratulating Mr. Päivärinne on the presentation of his paper in excellent English, spoke of the artistry manifested in Finland in many fields of design, such as architecture, furniture and lighting fittings.

Opening the discussion, Mr. J. G. Christopher said that it was very stimulating for the lighting engineer to learn about developments in countries like Finland, where conditions were so different in many respects from those at home. For instance, he had been told that in Finland there was snow on the ground for five months in the year and this must have a marked effect on street lighting. The periods of darkness in winter, too, were much longer than in this country. He remarked on the fact that in Finland the 40-watt fluorescent lamp was the most popular, whereas



Left: The President, F. X. Algar, G. Grenfell Baines and B. C. Ossitt. Centre: Mdme. Boereboom, A. H. Young, Andre Boereboom and J. G. Holmes. Top right: President and Dr. J. N. Aldington. Right: E. H. Lauth (U.S.A.) and J. M. Waldram.

here the 80-watt lamp was much more widely used. He and several subsequent speakers, including Mr. E. Harrison-Jones, expressed some surprise at the widespread use of anodised aluminium reflectors, while Mr. D. W. Durrant asked whether the surface was anodised before or after polishing and whether it was specular or slightly diffusing. Mr. A. G. Penny, after expressing the opinion that to-day it was the number of lumens per point that mattered more than the lumens per watt, asked whether the preference for the de luxe warm white lamp was due to its psychological effect in a cold climate. He said that he had never been able to understand the popularity overseas of reflector fittings for street lighting.

Mr. Päivärinne made a brief reply, promising to deal more fully later with the questions raised. He said that the average number of burning hours for the lighting in schools was from 400 to 1,000. This meant that, owing to the high cost of power, the initial price of a fitting was less important than its efficiency and the specular reflector was very good in this respect. It was, however, very necessary to avoid reflected glare. He thought the popularity of the 40-watt lamp was due to the fact that this rating was available in Finland for some time before the 80-watt lamp was manufactured.

The Brussels Exhibition

After a short break for coffee M. André Boereboom, of the Belgian Ministry of Public Works and Reconstruction, gave a well-illustrated account of the arrangements made for the "Lighting at the Brussels 1958 Exhibition." In the first section of the paper he described the electrical distribution system. The total connected load, he said, exceeded 60,000 kw. and the supply was capable of dealing with a quarter-hourly demand of 25,000 kw., with an overload capacity of 20 per cent. in excess of this. Power was taken from the thermal power station in Interbrabant, 4 km. away, and was delivered at 11,000 volts. The distribution arrangements were such that all but a few small consumers were supplied at high tension and in his paper M. Boereboom gave very full details of the secondary HT distribution system and of the LT (220-volt) system fed from it. The public lighting, he said, was supplied from a special low tension system which was cut out at midnight.

For the general lighting of the exhibition grounds a good deal of reliance was placed on the exterior illumination of the pavilions, but where these were widely spaced additional lighting was provided from fittings housing six 40-watt tungsten lamps at a mounting height of 12 metres, the spacing being about 20 metres. In the wooded parts of the grounds lighting was provided by projectors which illuminated the foliage. Filament lamps, colour-corrected mercury lamps and sodium lamps were used as seemed appropriate.

Part of the Belgian section of the exhibition was lit from 30-metre columns, each carrying a fitting with 12 1,000-watt mercury and four 1,000-watt tungsten lamps giving a total of over 700,000 lumens. The Place de Belgique, near the main entrance, was illuminated by the façade of the Reception Hall. The lighting of this façade was chiefly by cold cathode fluorescent tubing, used partly to outline the various designs and partly on the building, in a way which harmonised with the architectural features.

Special lighting effects were used in Osseghem Park, between the Belgian section and the foreign section of the exhibition, and for the footbridge which connected this Park with the Royal Park of Laeken, passing over the foreign section at a height of 17 metres.

The lighting of flower beds is always a difficult problem and M. Boereboom said that it had been decided not to employ the usual mushroom type of fitting. Instead, metal spheres were mounted on one-metre vertical steel rods, each sphere carrying three or four anodised aluminium reflectors which could be turned in any desired direction. Another device used for garden lighting was a 32-watt circular hot-cathode fluorescent lamp mounted on the support of a flower-pot container, the whole being enclosed in a fitting of formed extruded ceilulose acetate.

Finally, the reflections from the polished spheres of the Atomium gave a very striking and colourful effect supplemented by 320 10-watt lamps arranged in nine circles on the surface of each sphere and intended to represent the paths of the peripheral electrons associated with the individual atoms.

Pavilions and Fountains

M. Boereboom then went on to describe the interior lighting in some of the pavilions. This, he said, showed considerable diversity but several trends were noticeable, particularly the widespread use of spotlights, usually with 100- or 150-watt lamps, and the large-scale use of fluorescent lamps, usually concealed behind louvers or diffusing panels. In the Reception Hall the lighting was entirely indirect, whereas both Palais VII and Palais XI were lighted by ceiling-mounted 40-watt fluorescent lamps, the average

illumination values being 25 and 30 lm/ft² respectively. In the British Industry Pavilion, which was designed as a gigantic glass showcase, the largest part of the electrical load consisted of the lighting for the individual stands; the average lighting load was 15 watts per square foot of stand space.

The illuminated fountains in different parts of the exhibition were very attractive. In the central part of the avenue leading from the Place de Belgique to the Porte Benelux there was a water ladder, with three flights of 22, 17 and 12 steps respectively and ingenious devices for heightening the impression of water movement. The basins were lighted by cold cathode tubes of various colours.

In the lake in Osseghem Park there were seven illuminated fountains, each with a sequence of colour changes, while the Congo garden had some fountains with original and very interesting features.

To accompany the presentation of his paper, M. Boereboom showed a large number of colour slides of the various buildings and other features to which reference was made. Although, as pointed out in the subsequent discussion by several speakers who had already visited the exhibition, these pictures could not give any idea of the brilliance and delicacy of the original scene, they nevertheless indicated admirably the magnitude of the installations which M. Boereboom described.

The discussion was opened by Mr. A. H. Young, who emphasised the vastness of the exhibition and its demands on the stamina of the visitor. The Belgian section should certainly not be missed, he said, and he had high praise for the British contribution, which had been quite unjustifiably played down in certain sections of the Press. He concluded with the hope that the exhibition would stimulate interest in the exterior lighting of buildings in this country where there was much material that would well repay such treatment.

Mr. J. M. Waldram was another visitor who felt impelled to praise rather than to criticise the British pavilions, especially the Government pavilion. After referring to the really impressive engineering feats which had been performed in the city of Brussels, quite aside from the exhibition, he spoke of some of the features which could not fail to attract the visitor's attention, in particular the water ladder, or water stairway, which had been described in the paper. Dr. Ballin asked why, in the large clover-leaf fitting which formed part of the exterior lighting system, a tungsten lamp had been included with the mercury lamps. He expressed some surprise that no fluorescent lighting had been used for the trees in Osseghem Park. Mr. Cator said that a wonderful view of the façade of the Reception Hall was to be had from the top of the Atomium. The tree lighting he thought most attractive. Mr. S. Anderson asked whether, in view of the large lighting load with discharge lamps preponderating, there was any trouble due to low power factor. Mr. Boissevain praised the lighting of the German pavilion as outstanding, while both Mr. A. J. Dalton and Mr. G. F. Cole emphasised the impressive size of the various buildings which, they said, could not be adequately conveyed in a lantern slide. Mr. Cole thought the use of back projection in the British Government pavilion to show visitors something of the British way of life was most effective.

In his reply M. Boereboom said that the tungsten lamps in the clover-leaf fittings were part of the emergency lighting system; mercury lamps could not be used because of their delay in re-starting after extinction. The power factor of the system was 0.8 so that there was no trouble of the kind referred to by Mr. Anderson. He said that a publication describing the lighting of the exhibition was in preparation and would be available in due course.

Lighting and Architecture

Wednesday was the day on which the lighting engineer was forcibly reminded that in much of his work he was concerned with matters not susceptible of calculation or measurement. In the morning a paper entitled "Lighting and Architecture," by Mr. G. Grenfell Baines and Mr. A. L. Hogg, both of Grenfell Baines and Hargreaves, was read by Mr. Baines, who reminded his audience that some ten years ago, when speaking to the Society on the same subject, he had defined architecture as "the confining of space in certain forms by certain surfaces to afford graceful shelter for some human activity." The "gracefulness" resulted from visual satisfaction, which, in turn, depended on the relations between the dimensions of the enclosing surfaces. The desirable relations were to some extent liable to be modified by fashion, but what the lighting engineer had to realise was that anything which changed these relations changed the effect produced on the beholder.

For many centuries buildings were designed on the assumption that their forms and spaces would be revealed by daylight. Further, there was then every technical reason for a building to be full of detail and incident. To-day the demand for buildings of all kinds had so strained the resources of the industry that spaces had been reduced, ceilings lowered and embellishments eschewed. The techniques of building had been adapted to meet these new conditions and the visual effects had been modified accordingly. Floors and roofs were carried by steel and concrete over larger areas; pillars were fewer and walls were lighter, sometimes almost entirely of glass. Surfaces were simpler and enrichment came from large areas of natural materials or the daring use of colour.

Both old and new buildings needed light to reveal their forms but whereas the high spaces of an old building could tolerate the intrusion of hanging objects to some extent, in the reduced spaces of a modern building their avoidance by the use of built-in lighting was generally to be preferred.

The daylight in a room had certain characteristics which the lighting engineer should keep in mind. Chief among these were its directional quality and its variety. While no attempt should be made to provide an imitation of daylight, the artificial lighting should share these very desirable characteristics. Direction and variety, said the authors, might well form the basis of lighting in harmony with architecture.

Lighting should aim at defining the junctions between surfaces rather than blurring them, because it was in this way that the forms of the surfaces were appreciated. An example of the complete destruction of surface character by inappropriate patterns of light and shade was furnished by the suspended shallow semi-indirect bowl found in many a living room, with its hard-edged shadow sweeping from wall to ceiling and cutting off the corners of both.

Colour and Texture

The authors then went on to describe the use of colour by the architect to develop his forms and, sometimes, to counteract unwanted lighting effects which arose purely from function or economy. Both colour and texture were used in place of traditional ornament and texture could only be revealed by directional lighting.

Although the authors welcomed the use of lighting fittings attached to walls and ceilings and the further step resulting in the use of built-in lighting, they expressed some doubts about the louvered ceiling. The principal effect of a completely luminous ceiling, they said, was to destroy any sense of enclosure and make the walls of a room appear like detached pieces of scenery without any visible means of connection. A ceiling in which part was luminous and part was not might be even less acceptable, especially if the two

areas were roughly equal; as in the case of window spaces in a wall, there must be clear dominance of one over the other.

On the design of fittings the authors were very complimentary, saying that there had been steady improvement since the war, with the result that to-day there were dozens of simple fittings at the disposal of the architect.

The paper concluded with yet another plea for early collaboration between the architect and the lighting engineer. The architect, said the authors, grew up with his design and it was desirable for the engineer to do so too. This meant that the architect should acquaint the engineer with his scheme at a very early stage, in fact before the production of any design drawings. Then the architect should state his requirements in the form of a perspective sketch, indicating the brightest feature and the relative brightnesses of other surfaces, expressed in general terms such as "rather less bright," "darkest," and so on. This sketch might well show the positions suggested for the fittings and the main items of furniture. Only in some such way could the lighting engineer form a mental picture of the building and so be in a position to design a lighting scheme in accordance with the architect's conception.

Mr. Grenfell Baines made no attempt to present the paper as written. Instead he gave a most entertaining lecture on the same theme and illustrated it with a large number of colour slides. He also used a stage set of a room with a number of fittings which could be switched on in various combinations to bring out some of his points concerning the relation between the lighting system and the surfaces illuminated.

Mr. H. Hewitt opened the discussion by saying that he felt the authors had given lighting engineers food for a great deal of thought, especially with regard to the use of luminous ceilings. He asserted that in achieving the necessary harmony between lighting and architecture there were two main problems. The first was to locate the boundary between the respective spheres of action of the architect and the lighting engineer. Which of them, for instance, should specify the fittings to be used? The other problem was to establish easy communication between two people who, to a large extent, employed different terminologies. He referred to the lectures given by architects to lighting engineers as an attempt to solve this problem on the engineers' side and pleaded that architects, for their part, should learn how to communicate with the lighting engineer.

Mr. Waldram said that in any collaboration the first step was to decide upon what was required. This was the artistic side of the problem and when that had been settled the lighting engineer could usefully proceed with his calculations. He showed some slides of the new lighting in Gloucester Cathedral which had resulted from a collaboration of this kind.

Mr. A. E. Gaster thought that where the lighting was mainly functional, as in a control room, the lighting engineer would naturally have a greater say in the design than where aesthetic considerations predominated. The lighting engineer, he said, was not without aesthetic appreciation, but he often had difficulty in reconciling the architect's requirements with the provision of a good lighting service. Mr. Derek Phillips said that it was necessary to distinguish

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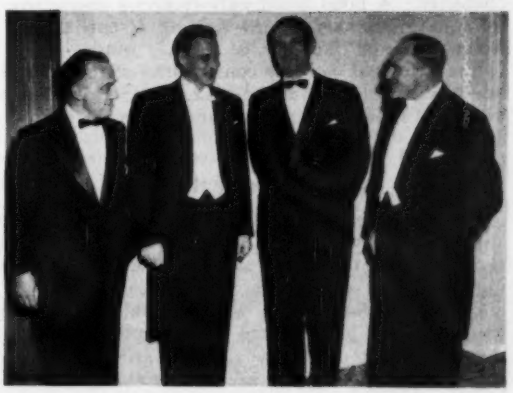

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The President and Mrs. Sawyer receiving guests at the dinner. (1) The Mayor and Mayoress of Eastbourne: (2) Mr. and Mrs. H. G. Campbell; (3) Mme and Jean Chappatt.

Bottom (4): P. Massart (Belgium), E. Paivarinne (Finland), A. Boereboom (Belgium), and C. C. Smith.

between the function of the lighting and the architectural function of the building. It was sometimes possible for artificial lighting, while in no way imitating daylight, to produce a similar effect. Mr. F. Widnall pointed out that many rooms had more than one function, so that flexibility in the lighting was most desirable. Frequently, however, this was difficult to achieve because of the limitations imposed by the supply system. The value of models for studying such matters as the interreflections in a room was urged by Mr. H. E. Bellchambers, while Dr. J. N. Aldington reminded both authors and audience of the limitations of photography for conveying a true impression of the appearance of an interior. Mr. Rettig put in a plea for a little more monotony here and there to provide a suitable environment for thought and restful contemplation. After Mr. Durrant had inquired whether Mr. Baines felt that an architect generally made a good interior decorator, the chairman, Mr. F. X. Algar, called upon the authors for their reply.

Mr. Hogg explained the point of view of the engineer who had always to consider costs and to see that provision was made for adequate wiring as well as for other services. Here Mr. Baines interposed to explain how this sometimes affected the design of a building at a very early stage. He dealt at some length with the subject of communication between the architect and the lighting engineer, urging that each should learn the other's language while still at the student stage. The architect had to be taught that "brightness adaptation" meant "getting used to the light," while the lighting engineer would probably need to be informed that "plastic integrity" meant "a form which expressed itself clearly and unambiguously." He concluded by defining collaboration as "striving after a common aim and sharing sovereignty in so doing."

Hotel Lighting and Atmosphere

The paper on Wednesday afternoon, too, dealt less with lumens per square foot than with the more intangible matters of "atmosphere" or "character" in lighting. The authors, Mr. C. Dykes Brown and Mr. W. R. Stevens (both of The General Electric Co. Ltd.,), justified the title they had chosen, *viz.* "Character and Compromise in Hotel Lighting," by saying that, while hotel managers were unanimous in placing great value on the creation of a suitable atmosphere, compromise was imposed by two considerations. In the first place the lighting, like the other services, had to be paid for within a strictly limited budget and in the second place the designer had to recognise the fact that the users of a hotel varied widely in their likes and dislikes. He was faced with a choice between boldness, which might appeal to a select few but offend many, and the safety which resulted in a scheme so ordinary as to be quite lacking in character. A hotel could only receive a major overhaul at infrequent intervals, so the lighting system should be one which was not likely to be quickly outmoded. Built-in lighting, integral with the construction of the interior, might be expected to have the necessary permanence and the designer should therefore always consider using this technique.

Welcoming the Guest

In their more detailed consideration of the lighting of specific areas the authors divided them into two kinds, *viz.* those used by the guests and the others, mainly the working areas such as kitchens, where efficiency was the important matter. Such areas were generally comparable with working areas in industrial and commercial premises and their lighting could follow accepted principles. It was in the "guest areas" that the need for creating an appropriate atmosphere was so important. This should be begun at the entrance hall and here the authors threw out an interesting suggestion which, whether practicable or not, illustrated their point very forcibly. Why not, they asked, have switching arrangements which could make the entrance appear warm and inviting on a cold winter's night, or cool and refreshing on a sultry summer's day?

In lighting a lounge, one difficulty was the absence of any natural focal point. Nevertheless the lighting should not be uniform but should provide areas of enhanced illumination by the use of a combination of general and local lighting.

Dining rooms were as various in purpose as in design; in general, the more Lucullian the repast the more subdued and intimate should be the lighting. On the other hand, for a banquet good general lighting was essential. Glass and cutlery were most attractive when they sparkled under a source of light of high brightness, such as a tungsten lamp.

In bars, said the authors, the designer could have his fling, in no other part of a hotel was the attempt to establish character so obvious. The focal point was the bar itself and it seemed to be generally agreed that there should be an attractive display of well-lighted bottles.

For lifts, indirect lighting seemed to be the best system. Bedroom corridors needed a subdued illumination of some 1 to 2 lm/ft^2, but the bedroom was the guest's home for the time being and in it he might wish to carry on a number of activities. The authors advocated two fixed lights from the ceiling with additional local lighting at the bed-head, the dressing table and the wash basin mirror.

Exterior lighting was recommended as a means of increasing the attractiveness of a hotel. In the country the building itself could be tastefully illuminated and the drive from the main road lighted with decorative post-top lanterns. An illuminated fountain was always an attraction and trees and flower-beds could be lighted at relatively low cost. An illumination of about 0.5 lm/ft^2 should be provided on car parks.

There were two addenda to the paper. One was an appendix describing how Waldram's method of designing the visual field might be applied to hotel lighting. The authors gave a simplified diagram connecting luminance and apparent brightness for any given state of adaptation of the eye, and illustrated the use of the method by means of some worked examples. The other addendum was an extensive table of recommendations for the lighting of different areas in a hotel. Besides values of illumination, the approximate watts per square foot required for tungsten lighting and for fluorescent lighting were given in each case and the type of lighting generally found most suitable was briefly described.

During his presentation of the paper Mr. Stevens showed a number of slides of hotel interiors and commented on the lighting schemes. He, too, used a stage set and showed how, by comparatively simple means, a drab and forbidding apartment could be converted into a cheerful and even attractive room.

The discussion was opened by Mr. F. Massey of the British Transport Commission who laid great stress on the economics of the problem and said that the introduction of fluorescent lighting would be greatly facilitated if the industry could produce a light-weight and inexpensive fitting suitable for lighting a bedroom. On the subject of portable lamps he said that the hotel manager looked with disfavour on flexible leads because of the accident risk involved. The lift might be looked upon as a "rising room" and lighted accordingly. In general, fittings for hotel lighting should not be too heavy and they should, as far as possible, be non-flammable.

The merits of well-lighted showcases, both as additions

to the interest in a foyer and as sources of revenue, were urged by Mr. H. Carpenter. He, too, expressed a dislike of trailing flex and asked whether the authors had come across a table lamp with a heavy base which could accommodate a storage battery and so make the lamp quite self-contained. He was followed by Mr. Penny who unashamedly avowed a preference for candles on the dining table.

Replying to the discussion, Mr. Dykes Brown said that he felt there was a future for the fitting which, although fixed to the structure, could be moved round so as to fulfil more than one purpose. He thought that many of the objections to flexible leads could be overcome by the use of suitable materials.

Annual Dinner

The concluding function of the Summer Meeting was the Annual Dinner and Dance held at the Grand Hotel on the Wednesday evening.

The principal guest was Dr. J. N. Aldington, who in proposing the toast of "The Society," said how pleased he was to be back again with his many friends in the Society. The IES, he said, after nearly 50 years' existence had reached a period of transition in its development at which it was necessary to give thought to the direction the Society was to take during the next half century. In proposing the formation of the IES in 1909 Leon Gaster had said that though the intention at that time was only to provide a common platform where all interested in lighting can exchange views, it was hoped that the time would come when expert lighting engineers would have a professional existence and be entitled to claim the distinction that the name implies. Dr. Aldington said that the Society had now reached a stage intermediate with the two phases mentioned by Gaster. The foundations had been well laid by such distinguished members as Walsh, Weston and Waldram to mention but a few who happened to be present at the dinner. The road ahead might be a difficult one, but with the example of its present and past members before it the Society should now look to the future and plan accordingly.

In reply the President said that Dr. Aldington's remarks had linked very closely with the theme of the meeting; the importance of lighting in productivity, for making life more pleasurable, in creating environment, had all been discussed at the technical sessions which had done a great deal to guarantee the future of lighting in this country. The greatest brake on lighting development was that so few people have yet seen what good lighting can do for them.

Mr. Sawyer also referred to his visits, often accompanied by Mrs. Sawyer, to the Centres of the Society where he had always been made most welcome. He said he had been glad to see at first hand the activities of the Centres, to meet many old friends and to make many more new ones. He thanked members for their support during his year of office and during the Summer Meeting and thanked Dr. Aldington for his views of the future of the Society.

The toast of "The Guests" was proposed by Dr. W. E. Harper, immediate past-president, who thanked the Mayor and Corporation of Eastbourne for their hospitality during the Summer Meeting and for the excellent facilities they had placed at the disposal of the Society. The reply was made by the Mayor of Eastbourne, Alderman S. M. Caffyn, who said that the general public have reason to be grateful to lighting engineers for the light and brilliance they bring into daily life.

On conclusion of the speeches the President presented the Dow Golf Cup to Mr. A. D. S. Atkinson who has now won the cup three times.

Display of Lighting Equipment

A review of the items included in the display of equipment at the Summer Meeting written by W. Robinson.

The Display of Lighting Equipment at the Summer Meeting was the brightest yet, and Mr. Nash and his colleagues who organised the presentation are to be congratulated on achieving a degree of sophistication which suggested the deployment of financial resources which were not, in fact, available to them. It was a neat touch, for example, to conceal lamps behind the section indicators. Taken as a whole the display was successful in presenting a forward picture of the lighting industry in so far as lamp development was concerned, but did not suggest, to the author at least, anything like the same vitality as regards luminaires and auxiliaries.

Lighting for Leisure

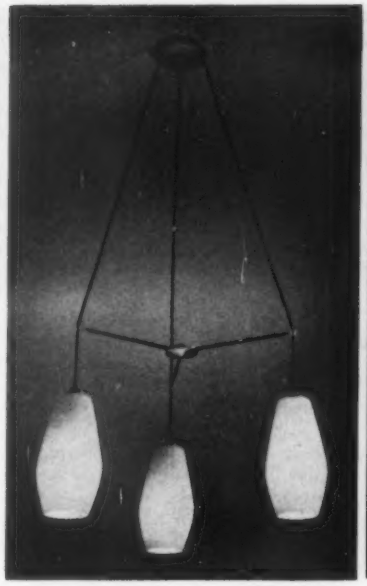
AEI, Atlas, H. W. Field, GEC, Knightshades and Troughton & Young, all showed representative specimens of their current ranges of luminaires or glassware. The new Linolite "Suite-lite" all-insulated fitting introduced a praiseworthy note of gaiety combined with practicality and economy, and we were able once again to appreciate the skill with which Merchant Adventurers have married style, efficiency and economy in their "Ventura" fitting, this time shown with its new optional reflector. The Herman Smith "Smithlite" luminaire commanded interest by the bold elimination of fluorescent lamp end connections, but occasioned regret that the rest of the fitting did not quite live up to the promise of the lamp.

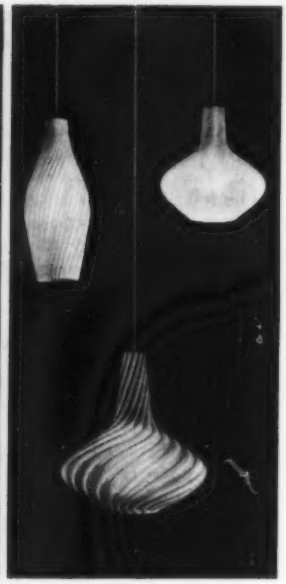
Lighting for Work

This section contained much of interest, and demonstrated how much happier is the engineer-designer producing lighting equipment for specific functions than is the artist-designer struggling with the imponderables of lighting for leisure.

Of particular interest was the AEI underwater unit for use in atomic reactors and made from materials which would not contaminate the water in the reactor, including super-purity aluminium for the main body and stainless steel for the front grill. The AEI watershed fitting, also shown, will be familiar to many, but the GEC non-corrodible fluorescent fitting, designed mainly for the food industry, was pleasingly novel in its approach, the two 5-ft. fluorescent lamps resting on corrugations made in the "Perspex" overall

Examples of lighting glassware. Left and above: Troughton & Young pendants; right: AEI 'Satina' pendant; far right: examples of GEC lighting glass.





enclosure. It is claimed that this gives maximum downward light, and who would dispute that! Interesting, too, is the single-end access to tubes and to the switchless start control gear.

Benjamin displayed their new, transparent patterned louvres which hang ingeniously from the upward light fins of "Fluroliers." Atlas and GEC each displayed specimens from their "family" range, the "Atlantic" and the "101" respectively, while Harris and Sheldon displayed their "Luveline" fitting with its provision for accurate alignment of fittings to form homogeneous lines.

Holophone showed their "Holoflux" prismatic louvres and a pressurised reflector bowl cast pendant fitting characterised by the combination of ruggedness with grace, which is a feature of their products.

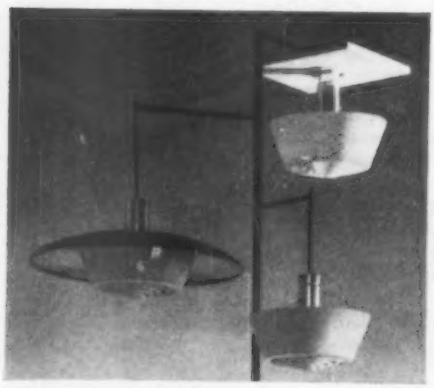
An interesting exhibit from Siemens Edison Swan was their new switchboard lighting unit using two 2-ft. 20-watt fluorescent lamps, one lighting the switchboard through louvres, the other giving upward general light through a diffusing panel.

Revo showed their interesting "Silver-Ring" bulkhead fitting for recessing in ceilings or walls. The fitting body is of aluminium alloy in two parts joined together by means of captive screws. Symmetrical or directional prismatic fronts, or clear or opalescent glasses can be used as required.

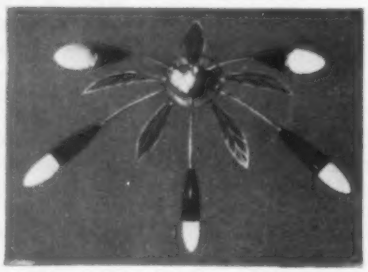
Exterior Lighting

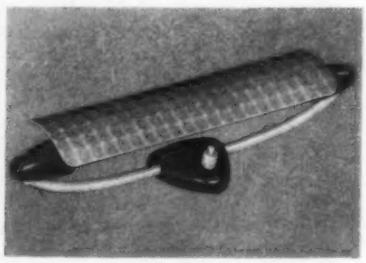
A notable feature of this section was the Atlas fluorescent reflector floodlight with four 5-ft. VHO fluorescent lamps rated at 150 watts. Apart from the interesting achievement of packing 150 watts into an 80-watt lamp size (albeit with some penalty in lamp life) it was interesting to note that the lamps were reflectorised, providing a neat method of packing four lamps into a narrow trough without sacrificing too much of their rearward light output.

Prominent also, in the dimensional sense particularly, was the GEC Tapered "Three-Eighty" fluorescent street lantern. The optical system impressed by its simplicity, consisting merely of two tapered "Perspex" refractors covering the lower portions of the tapered "Perspex" bowl, the upper portions being left clear. It was impossible to avoid the feeling that these delightfully simple optics would function equally efficiently under a less expansive roof and one wonders whether everything possible has been done to slim these monsters, even when all allowance is made for the supporting spine and the control equipment housed under the



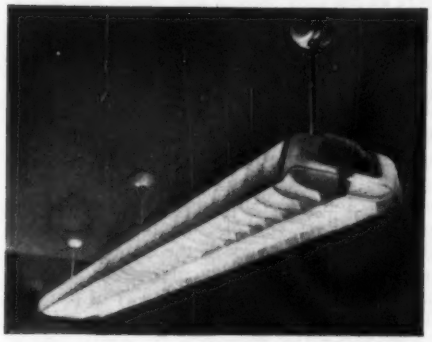
Left: Display of Merchant Adventurers 'Ventura' fittings. Centre: A Knightshades five-light pendant. Right: Linolite 'Suite-lite' fitting with clip-on shade.





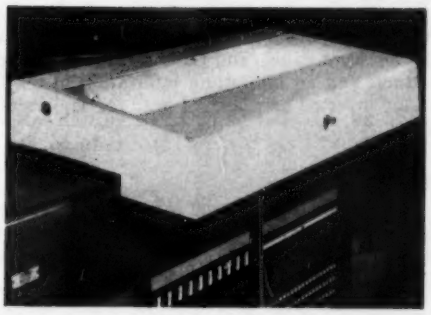
Beniamin plastic baffles fitted to a reflector fitting.

Revo 'Silver-Ring' bulkhead fitting.



Harris and Sheldon 'Luveline' fitting.

Siemens-Ediswan telephone switchboard lighting unit.



roof. Surely we should by now be able to produce fluorescent street lanterns more in keeping, as regards bulk and weight, with the lamps they house?

The Dorman and Smith cargo cluster fitting, also shown, is not new but is still interesting in the use made of grouped lamps to take the emergency out of a lamp failure.

GEC showed in this section a high tower floodlight as used for football field lighting, and a heavy duty quayside lantern which must be the envy of all street lighting engineers bedevilled by the activities of sportive youth.

Siemens Edison Swan showed their "Firth Bay" lantern with its integral wall mounting bracket and control gear box, while Revo displayed their "Junior Sol-etern" and "Sol-D'or" lanterns.

Revo 'Junior Sol-etern' lantern.

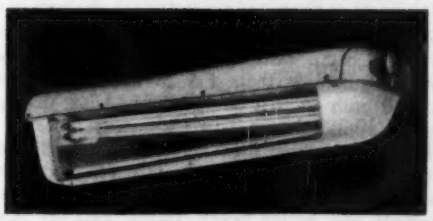
Siemens Ediswan 'Firth Bay' wall mounting lantern.

Display Lighting

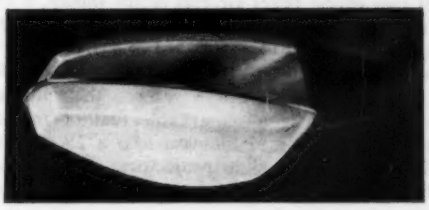
This section frankly disappointed, not for what was there but for what was not. AEI, Atlas and Courtney Pope handsomely showed their display lighting ranges, a novel item being the Courtney Pope "Mobiliter" best described as a kind of pogostick, sprouting adjustable lamps and display shelving, designed to compress between the floor and roof of display windows and hence to provide a quickly erected lighted display feature. The same firm are to be congratulated on their bold use of 12-volt lamps in their TA 63 fitting, but one wonders whether the use of uncapped lamps in shallow reflectors is the best way to exploit the beam producing potentialities of these lamps, and whether the colouring of reflectors is an unmixed blessing. At least, however, the first hurdle has been taken; now what about producing a spotlight that really *is* a spotlight!

The GEC clip-on spotlight reflector was interesting for the use made of super purity aluminium (an up and coming reflector material), for its deep cut-off eliminating the need for louvres and for the use of a three-spring system to ensure correct focus

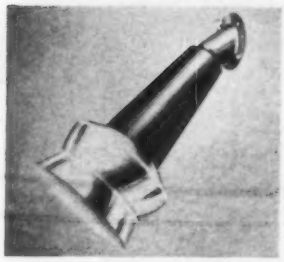
GEC tapered 'Three-Eighty' lantern.



Atlas 'Alpha Three' lantern.



Courtney Pope TA63 low voltage spotlight.



GEC dip-on spotlight reflector.

AEI 150-watt reflector spotlight.

Transport Lighting

AEI showed their soundly conceived "Clean-light" semi-recessed ceiling light for traction use. Atlas showed electro-luminescent panels and GEC showed two aerodrome lighting fittings and an interesting innovation in the form of a transistor inverted and control gear for fluorescent lamps in aircraft.

Light Sources

The show really came to life in this section and we were afforded those glimpses of things to come which are, and long may they be, the principal attraction of the Summer Meeting Display.

The GEC were well to the fore with their prototype quartz envelope linear tungsten filament lamps which pack a great punch into a small space. Interesting, too, was the prototype de luxe colour corrected mercury fluorescent lamp giving, for the first time, a colour rendering fully comparable with the colour matching fluorescent tube.

Interesting possibilities for the improvement of lumen maintenance, particularly of projector lamps, are contained in the use of a zirconium coating on filament leads as a continuous "getter," shown by GEC who have also applied themselves to a study of the best shape of filament lamp envelope for use in dusty atmospheres, the result being a GLS lamp with a modified bulb with vertical sides and a smaller area over which dust can collect. Gains of 15 per cent. in light output through life can be achieved with this design. Perhaps we may hope that this will lead, not to a further proliferation of lamp varieties, but to a study of bulb shapes generally from this important angle.

Also shown by the GEC were an electronic dimming cabinet capable of dimming up to 32 80-watt fluorescent lamps at a time and an artificial daylight colour matching cabinet with provision for detailed colour adjustment.

AEI were also well to the fore with some interesting items, including their FA 29 xenon flash tube and a new round bulb 40-watt lamp of only 2 ins. diameter for limited space applications. This lamp has an inside white coating. They also showed their version of pressed glass floodlighting and spot lighting lamps. Greater accuracy of reflector contour and filament location provide, it is claimed, a higher output and better beam control and the lamps can safely be exposed to the weather. Pressed glass is also the basis of two sealed beam aircraft lamps shown, a 28-volt 600-watt landing light and a 16.6 A 200-watt glide approach indicator lamp. May we look forward to sealed beam car headlamps now that the pressed glass technique has at last arrived here?

Siemens Edison Swan showed their miniature projector lamp which, by a remarkable feat of manufacture, packs a 500-watt flat grid filament into a 25 mm. soft glass bulb for use in small slide projectors. They also showed their 1,000-watt MEX/D lamp, a high pressure compact source lamp with a mixture of mercury vapour and xenon gas giving 50 lumens/watt.

Undoubtedly the most important exhibits, and probably the most interesting, were those illustrating the progress in achieving a higher loading for fluorescent lamps without detriment to life or efficiency. Both AEI and GEC showed how this could be achieved by various methods of achieving a cool space within the tube and hence controlling mercury vapour pressure. The interest of this lies not only in the variety and ingenuity of the methods used but also in the possibilities thus opened up for extending the field for fluorescent lighting and for up-grading the light output of existing fluorescent installations, in particular street lighting. No doubt there are practical difficulties in the way of producing ballasts for 120-watt 5 ft. lamps which are dimensionally interchangeable with those for 80-watt 5 ft. lamps, but if this can be achieved (and similarly for other sizes in which high output tubes will no doubt become available in time) the reward for success is great and we must wish the manufacturers luck. May it also be suggested that fittings manfacturers and lighting engineers would do well to recognise that the somewhat casual attitude at present adopted to the shielding of fluorescent lamps will not be tolerable with high output lamps. Please don't let us fumble the introduction of these lamps as we fumbled the others.

Ekco-Ensign showed their fused terminal block, taking BS cartridge fuses and, *anno mirabile*, a "cut-out" starter switch. We can commend their enterprise while at the same time wondering what circumstances peculiar to this country prevented the introduction of this simple and cheap device until at least five, or maybe ten, years after its successful introduction in the USA.

Research

The most prominent display in this section was the AEI exhibit illustrating the factors involved in the appraisal of street lighting installations. One could hardly fail to be impressed by their comprehensive approach to the subject and, even if the waters run too deep for many of us, at least we can be grateful for this reminder of the difficulty of the subject. Benjamin showed a conditioning cupboard for proving dust-tightness and GEC contributed fuse testing and shock testing equipment and a pretty demonstration of the separation of gases in a discharge tube which suggested to the author a possible and simple means of adding still further interest to gas discharge advertising signs.

Miscellaneous

AEI showed their 2-kw xenon lamp developed for cine projection. GEC showed a 2-kw television studio spotlight and ICI some of their new plastic materials. Oldham & Son showed a range of very rugged accumulator fed lamps for mines and industrial situations, including a shunter's lamp

(continued on page 253)

Testing Switchless-start Fluorescent Lamp Ballasts

By J. E. GREENHILL*

There are now several types of tubular fluorescent lamps and for each lamp type there are many different circuit arrangements for starting and operating the lamps. The lamp type most popular in this country is the pre-heated hot cathode lamp in which the cathodes are (or should be) heated before the lamp is started. There are basically two circuit arrangements for this lamp type:—

(a) Switch-start circuits, where the ballast is a simple series impedance and automatic or manual switches are used to pre-heat the cathodes and then start the lamp by producing a pulse.

(b) Switchless-start circuits. In addition to a series impedance, the ballast may in this case incorporate a transformer for heating the cathodes and a pulse may also be generated to assist lamp starting.

Specifications dealing with switch-start circuits already exist but for the more complex switchless-start circuits the position is far from clear.

In a simple switch-start circuit, the performance of the ballast may be determined by either of the following methods:—

(a) Comparing its volt-ampere characteristic and its power factor with those of a high quality standard inductor (reference ballast). A lamp is not needed for this comparison.

(b) Operating a reference lamp firstly with a reference ballast and then with the sample ballast, measuring lamp watts, lamp current, lamp volts, etc., in each case.

These two methods are included in BS.2818 "Auxiliaries for Operation of Fluorescent Lamps," which at present deals only with 80-watt switch-start ballasts.

With switchless-start circuits, however, it is often difficult to measure lamp current and lamp watts, and there is some doubt regarding the correct definition of "lamp watts."

The object of this article is to outline the difficulties involved in testing such circuits or ballasts (lamp-starting tests are not included) and to suggest a simple method which can be applied to any circuit arrangement.

The circuit shown in Fig. 1 is the conventional choke switch-start circuit with instruments connected for the measurement of lamp current and lamp watts.

Of the numerous circuits available for starting and operating pre-heat-type fluorescent lamps without starter switches, the two types shown in Figs. 2 and 3 will suffice to illustrate the problems involved in making measurements in such circuits.

The terminology for the circuits shown in Figs. 2 and 3 has a somewhat unfortunate history. In this country the two terms generally used are "quick-start" and "instant-start." The American "rapid-start" circuit is basically similar but uses lamps with special triple-coiled cathodes. The use of the term "instant-start" is particularly unfortunate since it has been used by the Americans for many years to describe a completely different circuit, i.e., a circuit in which hot cathode lamps are *cold-started* by means of a high voltage and the cathodes are not heated prior to the lamp starting. For these reasons the term "quick-start" will be used here.

*Thorn Electrical Industries Ltd.

Lamp Current

In quick-start circuits such as that shown in Fig. 2 lamp current can be measured directly by connecting an ammeter in the circuit at point A. In circuits where this direct measurement is not possible (Fig. 3) a differential current transformer can be used in conjunction with the ammeter.

Lamp Watts

Several methods have hitherto been suggested for the measurement of lamp watts, etc., in quick-start circuits. With these methods the following measurements are made:—

(1) Total watts input to the circuit (circuit watts).

(2) Lamp arc watts (including losses in the cathode due to the arc current).

(3) Losses in each cathode due to the heating from the quick-start transformer (lamp operating).

These methods are very elaborate and are far from accurate since many measurements are involved, and with one method accurately set resistors are connected in circuit.

The object of at least one of these methods appears to

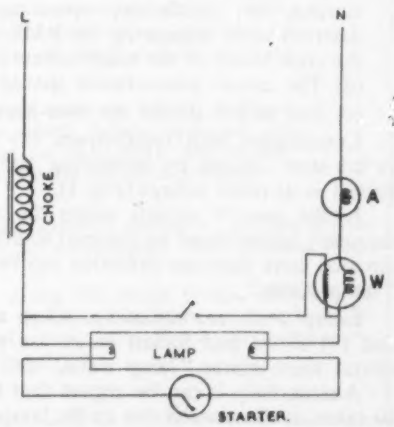
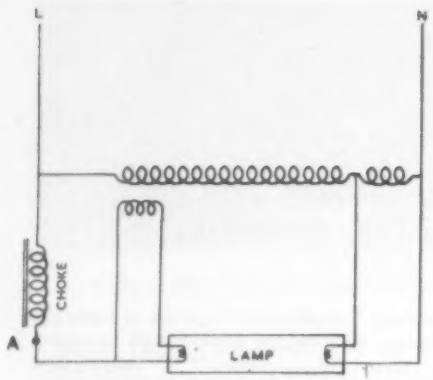
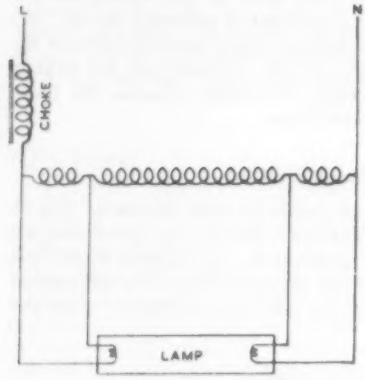


Fig. 1. Conventional choke switch-start circuit.





Figs. 2 and 3. Representative quick-start circuits.

be the "measurement" of the losses in a quick-start circuit, whereas this aspect has little importance provided the ballast complies with the temperature-rise requirements (i.e., does not overheat).

The important requirements for any fluorescent lamp circuit are :—

(a) The lamp should give the required light output : this means, with switch-start circuits, operating the lamp at or near to its objective watts.

(b) The total power input to the circuit should not be excessive.

(c) The ballast should not reduce lamp life, either due to the starting process or due to the steady operation of the lamp. (We are not concerned here with lamp starting, but satisfactory operation of the lamp is determined by measuring the RMS lamp current, and the crest factor of the lamp current.)

(d) The circuit power-factor should be good.

(e) The ballast should not over-heat.

Compliance with requirement (a) is determined in switch-start circuits by measuring lamp watts with the ballast at its rated voltage (Fig. 1).

In the case of circuits where the cathodes are continuously heated from an external source (e.g., quick-start circuits) more than one definition can be given to the term "lamp watts."

Lamp watts are sometimes taken as the sum of (2) and (3) above and ballast losses are then calculated as circuit watts minus "lamp watts," i.e., 1 - (2+3).

Alternatively it can be argued that lamp watts should be taken as those watts due to the lamp (arc) current, i.e., the arc watts plus the losses in the cathodes due to the arc current.

These two definitions of lamp watts may be summarised as follows :—

Definition A.—Arc watts, plus losses in the cathodes due to the arc current, plus losses in the cathodes due to heating from an external source.

Definition B.—Arc watts, plus losses in the cathodes due to the arc current.

Definition B is in fact the same definition as that which applies to switch-start circuits.

It has been found, however, that lamp watts (whichever definition is used) is not a reliable criterion on which to judge lamp behaviour in quick-start circuits. This is because, for a given light output the lamp watts (definition B) decrease as the cathode heating is increased. If definition A is considered, lamp watts increase with cathode heating for the same light output, since the cathode heating losses increase at a greater rate than the decrease in arc watts.

Thus in either case lamp watts and therefore lamp efficiency (i.e., lumens per watt) would depend upon the level of cathode heating. This situation is obviously unacceptable and lamp efficiency must continue to be determined by measurements in switch-start circuits.

Test procedure

As previously mentioned, the criteria for quick-start circuits are :—

(1) Light output of the lamp.
(2) The total power input to the circuit (circuit watts).
(3) Combination of (1) and (2) giving a measure of the efficiency of the complete circuit.
(4) Lamp current (RMS).
(5) Crest factor of the lamp current.
(6) Temperature rise of the ballast.

To determine these criteria the following procedure should be adopted :—

(a) A reference lamp should be operated with the reference ballast at rated voltage, and the following measurements should be made :—
(i) Total input (circuit) watts W_1
(ii) Light output of the lamp (or centre 6 in. of the lamp). L_1

(b) The procedure detailed in (a) above should be repeated (under the same conditions of test) with the same reference lamp operated with the sample ballast at rated voltage(s).

If the measured input watts and light output with the sample ballast are called W_2 and L_2 respectively, the relative light output can be determined by the ratio $\frac{L_2}{L_1}$, and the efficiency of the sample ballast relative to the reference ballast can be found by the following formula : —

$$\text{relative efficiency} = \frac{L_2}{L_1}\frac{W_1}{W_2} \times 100 \text{ per cent.}$$

(c) Lamp current should be measured directly where possible but with circuits such as that in Fig. 3 a differential current transformer and ammeter should be used.

(d) The crest factor of the lamp current should be determined by means of an ammeter, resistor and calibrated oscilloscope. For circuits such as that in Fig. 3 a differential current transformer should also be used.

(e) The power factor of the circuit and the temperature rise of the ballast should be found by the usual methods.

Specification (Efficiency and lamp operation clauses)

A specification for quick-start ballasts should also cover the regulation of the ballasts. It is suggested that the following clauses relating to lamp operation should be included in existing switch-start ballast specifications to enable these specifications to cover quick-start or rapid-start ballasts.

The conditions of test, ambient temperature, supply frequency, etc., should of course be those already contained in the particular specification.

(a) At rated voltage(s) the ratio of light output $\frac{L_2}{L_1}$ shall be not less than 92.5 per cent.

(b) At any supply voltage between 90 and 110 per cent. of the rated value(s) (and with the reference ballast operated at a corresponding voltage) the ratio of light outputs $\frac{L_2}{L_1}$ shall be not less than 85 per cent.

(c) At rated voltage(s) the efficiency of the sample ballast circuit relative to the reference ballast circuit shall be not less than 80 per cent.

(d) With the sample ballast operated at rated voltage(s) the reference lamp current shall be not greater than 107.5 per cent. of the value obtained with the reference lamp operated with the reference ballast at rated voltage.

(e) With the sample ballast operated at rated voltage(s) the crest factor of the lamp current waveform shall be not greater than 1.7.

Cathode heating

The importance of cathode heating has not been overlooked. Excessive cathode heating with the lamp operating *will* cause short lamp life, but the light output and relative efficiency clauses preclude ballasts which give excessive cathode heating. In any case, the accurate measurement of cathode heating is extremely difficult since actual lamp cathodes are not reliable for this purpose and substitution resistors would need to be used. This would then upset the distribution of lamp current and cathode heating current so that a false impression would be obtained.

Display of Lighting Equipment

(continued from page 250)

with provision for colour signalling, and including a double filament lamp as security against filament failure. Strand Electric showed a remotely controlled colour change wheel in operation on a baby mirror spotlight; control being by means of a six-position rotary switch enabling selection of any of five colours or continuous rotation of the colours.

AEI neatly rounded off the exhibition with a peep show which might well have been labelled "What the Butler Saw," except that what was, in fact, seen was a positive image of Dr. Walsh produced by selectively quenching a phosphorescing screen by infra red passed through a photographic negative.

Afterthought

The IES Summer Meeting Display is well on the way to becoming an institution; but institutions don't automatically improve with the years, they need constant vigilance from within and refreshment from outside. A critical analysis of this year's display reveals one or two disturbing features. For instance out of some 150 Sustaining Members, of whom about 60 are manufacturers, only 20 exhibited. Out of some 80 items displayed two Sustaining Members contributed 40.

If we eliminate those exhibits which were neither new introductions nor embodied any new development we are left with a nucleus of items which constituted the heart of the exhibition and it is only fair to those who give the show this heart to ask "What of the Others"? May we hope that the next Summer Meeting Display will give the answer?

Situations

Vacant

AEI Lamp & Lighting Co. Ltd. has immediate vacancies in its Lighting Department for (a) LIGHTING ENGINEERS. Preference will be given to Diploma Members of the IES or those prepared to train for this qualification. (b) COMMERCIAL ASSISTANTS or clerks for quotation, order and marketing work.

Successful applicants will be required to work in London for an initial period of a few months, but later this year the Department will be moving to its permanent Headquarters in Melton Road, Leicester.

Replies stating age, qualifications, experience and salary required will be treated in confidence and should be addressed to:—Manager, Lighting Dept., AEI Lamp & Lighting Co. Ltd., Mazda House, 44, Fitzroy Road, N.W.1. Applicants may be required to attend for an interview in Leicester or London.

JOSEPH LUCAS (ELECTRICAL) LIMITED

ENGINEERS & PHYSICISTS

As a result of expansion of our road vehicle lighting development department to meet the growing demands of the motor industry we have vacancies for engineers and physicists of at least Higher National Certificate standard to work on the following projects. Experience or knowledge of photometric and electrical instruments is desirable.

The design and development of vehicle lighting equipment, and in particular the development of optical systems for future products.

Development work on specific problems related to vehicle lighting equipment and the design of laboratory and factory control equipment for these products.

These positions carry attractive starting salaries and provide excellent prospects for advancement. Staff Pension Fund.

Apply in writing, giving full details of age, qualifications and experience to the Personnel Manager, Joseph Lucas (Electrical) Limited, Great King Street, Birmingham 19, quoting reference PM/D/231.

Lighting Abstracts

OPTICS AND PHOTOMETRY

535.64

577. A new look at the measurement of light and color.
D. B. JUDD, *Illum. Engng.*, **53**, 61-70 (*Feb.*, 1958).

The influence of the Helmholtz-Kohlrausch effect on the accuracy of visual heterochromatic photometry is discussed. The establishment of the 1931 CIE standard observer and co-ordinate system for colorimetry, based on Grassmann's laws, is then described. Discrepancies between the standard of colour and actual observations have led to a more careful redetermination of the colour-mixture functions being made at the NPL. Preliminary results indicate a minor revision at the short-wave end of the CIE standard luminous-efficiency function and a major revision throughout the whole spectrum. P. P.

535.65

578. Measurement and specification of color rendition properties of light sources.
D. NICKERSON, *Illum. Engng.*, **53**, 77-86 (*Feb.*, 1958).

The selection of suitable standard light sources for the measurement and specification of colour rendering is first considered. The three CIE standard illuminants can be supplemented with sources defined by the Planckian radiation law (for low colour temperatures) and with the Abbot-Gibson series of illuminants (for high colour temperatures). The CIE chromaticity diagram can be used for colour specification, but has disadvantages when assessing subjectively the colour differences between Munsell test patches under different illuminants. The Adams's Chromatic-Value Diagram is of advantage here. P. P.

LAMPS AND EQUIPMENT

535.24

579. IES Guide for photometric testing of outdoor fluorescent luminaires.
Illum. Engng., **53**, 105-111 (*Feb.*, 1958).

Prepared by a Sub-Committee of the American IES, this Guide deals with all aspects of the photometric testing of fluorescent luminaires intended for high or low mounting outdoors. High-mounting luminaires can be tested by either a relative or a direct method and are specified by both candle-power distributions and isolux diagrams. Low-mounting luminaires are specified by illumination and candle-power distributions. Corrections to an ambient temperature of 25 deg. C. should be made in every instance. Appendices describe how this can be done, and also give a pro-forma report form and various conversion tables. P. P.

535.241

580. Luminous flux calculation from the light distribution curve of a concentrating lighting fitting
R. VOLLMER, *Lichttechnik*, **10**, 113-115 (*March*, 1957). *In German.*

The luminous flux from a lighting fitting, such as a narrow-angle shop window reflector, cannot be found accurately from the Rousseau curve because of its awkward shape. The author proposes a method in which a curve of more convenient shape is drawn. The abscissae represent angles $\Gamma(\alpha)$ from the axis of symmetry, while the ordinates represent values of $I\alpha \sin \alpha$, where $I\alpha$ is the luminous intensity at angle α, so that the area under the curve is proportional to the total flux. J. W. T. W.

621.327.5

581. New type of xenon lamp.
A. LOMPE, *Lichttechnik*, **10**, 108-109 (*March*, 1958). *In German.*

Describes two new high power xenon lamps taking 20 and 65 kW. respectively. The gas is at about 1 atm. pressure during operation and the quartz tubes, which are straight, are respectively 1,900 and 2,400 mm. long. The smaller lamp is 30 mm. in diameter, takes 75A and has an efficiency of 28 lm./w. For the larger lamp the figures are 500 mm., 250A and 31 lm./w. The operating voltage is 270 for both lamps. J. W. T. W.

LIGHTING

628.9

582. Acoustics and lighting.
G. W. CLARK, *Illum. Engng.*, **53**, 93-99 (*Feb.*, 1958).

The trend towards higher levels of artificial lighting, particularly when associated with luminous ceiling techniques, means that the lighting engineer is in direct competition with the acoustical engineer for ceiling space. The acoustical problems involved in sound absorption and insulation are briefly described. Noise Reduction Coefficients are calculated for six typical office ceilings in which the acoustical and lighting requirements have been combined. It is shown, however, that the psycho-physical concept of "loudness," which is much more difficult to compute, is not directly related to the N.R.C. P. P.

628.871

583. Outdoor lighting design for New York International Airport.
A. H. FEDER, *Illum. Engng.*, **53**, 142-149 (*March*, 1958).

Original plans for the lighting of the 160-acre plaza of the International Airport at New York would have involved using 275 lighting poles and producing an average illumination of 1.5 lm/ft². To meet the revised requirement for a much higher level of illumination from far fewer poles with a minimum of glare, special lamps, luminaires and towers were developed. The resulting 3-8 lm/ft² is achieved from approximately 340 projection-type luminaires mounted on 43 seventy-five feet high towers, the lamps being 1,500-watt mercury with 12-in. light-centre length in quartz tubes. P. P.

628.972

584. Lighting of churches and assembly halls.
L. C. KALFF: K. SUND: M. DERIBERE: R. HODEL, *Bull. Assoc. Suisse des Electriciens*, **49**, 205-222 *and* 243-247 (*March*, 15, 1958). *3 papers in German; 1 in French.*

These four valuable papers were delivered at a symposium of the Swiss Illumination Committee, held in Lucerne in December, 1957. The first deals with the principles to be followed in using modern light sources in old ecclesiastical buildings. Descriptions are given (with illustrations) of successful installations in churches of romanesque, gothic, baroque and later styles. The second paper describes the modern lighting with fluorescent lamps of the famous Benedictine church at Einsiedeln, near Zurich. This is baroque at its finest and the lighting installed in 1954 was very carefully designed to harmonize with the architecture. The description is very detailed and the photographs give a good idea of the effects produced. The third paper (in French) sets out general principles for the lighting of a conference hall with auditorium and smaller halls. The use of colour receives special attention and it is recommended that provision should be made for the illumination level to be altered according to the use to which a room is put. Luminous ceilings are often used to provide the main part of the lighting in an auditorium. The fourth paper describes (with photographs) some modern lighting installations in churches in Lucerne. J. W. T. W.

INSTALLATIONS

Church at Hamilton, Ontario

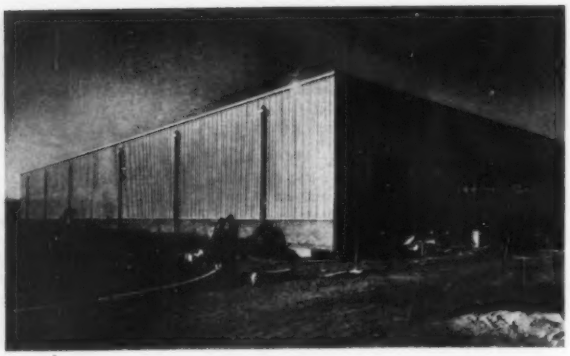
The church of St. Augustine of Canterbury at Hamilton, Ontario, was completed in April of this year. The church is 72 ft. long by 42 ft. wide, and the height to the apex of the ceiling is 72 ft. It is lit by 12 groups each of three Rotaflex opal/pearl shades suspended by wires from the ceiling. The architect was Frank H. Burcher and the lighting was installed by Culley Lawson.

Institute of Marine Engineers

A new building for the Institute of Marine Engineers has recently been erected in Fenchurch Street. The interior of the lecture theatre shows an unusual departure from traditional interiors of this kind. Colour is used boldly and the lighting adds to the sense of space. The architects were Ronald Ward & Partners; the consulting architect was Victor Wilkins, FRIBA; the lighting was carried out by Troughton & Young (Lighting) Ltd.

Dickins & Jones

Special cold-cathode fittings have been installed at the Dickins & Jones store in Regent Street. Two sizes of fitting are used, 17 ft. 6 in. x 3 ft. housing 12 tubes, and 9 ft. 9 in. x 3 ft. housing six tubes. Both types are suspended from the ceiling beams by short rods. The transformers are carried on the central spines of the fittings. For ease of maintenance the glazed undersides hang down to expose the tubes and cable, other wiring and control gear being accessible from hatches in the top of the spine. The average illumination provided is 40 lm/ft^2. The fittings were made by George Forrest & Son Ltd. to the designs of Trevor Dannant, ARIBA, in collaboration with Drake & Gorham, who also carried out the installation work.



Semiconductors, Swindon.

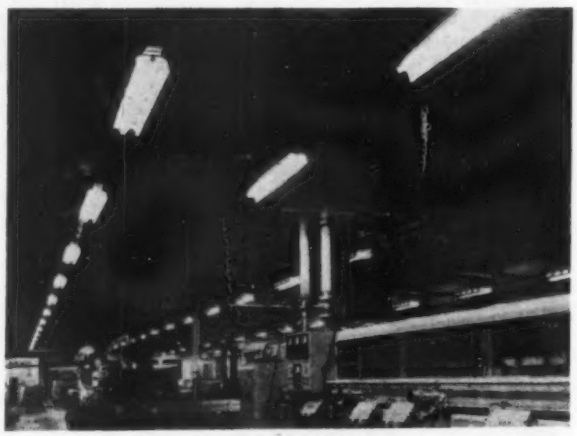
Windowless factory of Semiconductors Ltd., Swindon

This factory is engaged on the production of transistors and was made windowless to limit the ingress of dust. The work involves exacting and precise techniques and a high intensity of well-diffused lighting was required. It was also desired to retain the maximum flexibility of layout so that production lines can be revised as manufacturing techniques change; all partitions are movable on an 8 ft. x 4 ft. grid with lighting fittings and air conditioning diffusers on the same grid. Bearing in mind the necessity of minimising dust ledges the fittings had to be set flush with the ceiling and themselves had to be dust-proof yet simple to maintain.

The fitting used consists of a welded sheet metal box-form reflector housing having a wide flange which fits into a recess in the suspended ceiling against a rubber gasket. Three 5-ft. 80-watt fluorescent lamps (warm white) are used in each fitting. The control gear chassis is wired and fitted as a detachable independent unit to the reflector housing. The fitting is sealed with a flanged opal "Perspex" dish which is secured to the frame of the reflector housing by special clips.

The floor area is 20,000 sq. ft. and the ceiling height is 12 ft. 250 three-lamp fittings are used giving an average illumination of 80 lm/ft^2.

The consulting engineers for this factory were E. J. Cook and Co. (Engineers) Ltd.; electrical services were by Matthew Hall and Co., Ltd., and the lighting fittings were made by R. and A. G. Crossland Ltd.



Bottling department at John Smith's, Tadcaster.

Brewery at Tadcaster

A scheme to modernise the John Smith's brewery at Tadcaster is now nearing completion and much new plant has been installed, including new lighting equipment. Fluorescent lighting with vitreous enamelled reflectors on trunking have been used and the illustration shows the high-speed bottle-washing and filling department. An average illumination of 11 lm/ft^2 is provided. The lighting equipment and trunking were supplied by Crompton Parkinson Ltd.

Sperry Gyroscope factory

Trunking is also used in the new Sperry Gyroscope factory in Berkshire where an illumination level of 60 lm/ft^2 is provided by a mixture of 'Daylight' and 'Warm White' lamps. The fittings are suspended 13 ft. above the floor and give upward light on to the ceiling. The electrical contractors were Rashleigh Phipps and Co. Ltd. and the lighting equipment and trunking were supplied by the AEI Lamp and Lighting Co. Ltd.

Sperry Gyroscope factory

Lighting a compost heap

A new floodlighting system now installed at Europe's largest mushroom farm, owned by A. G. Linfield, Ltd., at Thakeham, Sussex, is a major step towards quickly fulfilling a plan to increase production from 5,000,000 lb. to 7,000,000 lb. a year. Eventually the annual output is expected to reach 9,000,000 lb. The system, planned and supplied by the G.E.C., comprises seven 1,000-watt medium angle symmetric-beam floodlights mounted on 30-ft. steel poles and seven 500-watt 'Duoflex' floodlights, mounted at 20 ft., installed on opposite sides of the open yard (80-yard square) where 15 men and two specially designed dung-turning machines produce 460 tons of mushroom-growing compost every week. The system is enabling Linfield's to introduce day and night shift working in order to raise the output of compost to provide the additional 2,000,000 lb. of mushrooms annually to meet the requirements of the new production programme.

A. G. Linfield's 1,000-acre farm and market garden comprises a number of units located around Thakeham, all fitted into a cycle of production of which compost made from pig and stable manure is the beginning and the end. The cycle begins with corn and fodder-beet—which provides food for an annual output of 5,000 baconers—and straw for littering down. The pig manure helps form the compost on which the 5,000,000-7,000,000 lb. of mushrooms are grown, and the spent compost is used as manure for growing more crops for pig food, tons of vegetables, roses under acres of glass, carnations, and a large output of orchids.

Book Reviews

"The Social History of Lighting," by W. T. O'Dea. Pp. xvi+254; Figs., 59 drawings and 32 pp. of half-tones. Published by Routledge and Kegan Paul, London, 1958. Price 42s.

The author's name will be familiar to many lighting engineers, particularly those who were in any way associated with the "Darkness into Daylight" exhibition held at the Science Museum in 1948, or the earlier exhibition of electric lighting held there in 1936. For each of these Mr. O'Dea prepared an informative and eminently readable handbook and it is interesting to note that in the preface to the present book he writes "it has taken ten years to write the script." The conclusion seems inevitable that it was "Darkness into Daylight" which aroused Mr. O'Dea's interest and so led indirectly to the production of the present volume.

Considering the immense influence on man's activities which the means for continuing them after dark must necessarily have had, it is astonishing that the literature of the history of lighting is so scanty. Mr. O'Dea mentions only three books (there is at least one more, but this deals only with street lighting) so that he has had to carry out an immense amount of research in order to produce a balanced picture. His research, moreover, has not been confined to tracking down references to lighting matters, many of them quite incidental, in authors from Homer to the present day; he has procured reproductions of all the earlier sources of light, from a primitive oil lamp burning various fuels (including fish oil which, he reports, "was inclined to stink") to the various types of candles.

The amount of work involved must have been prodigious; only someone fascinated by his subject could have persevered to the completion of what is undoubtedly both a notable contribution to social history and a volume of absorbing interest to anyone who looks upon the lighting engineer's work as a service to the community.

There are, inevitably, a few minor blemishes, such as the consistent misspelling of the well-known names *de Saussure* and *Chrysostom*, while the index presents certain peculiarities, but such matters as these can easily be rectified in a future edition.

J. W. T. W.

"Lighting the Stage," by P. Corry. 2nd Edition. Pp. 157, 16 plates. Published by Sir Isaac Pitman & Sons Ltd., London, 1958. Price 25s.

"The Technique of Stage Lighting," by R. Gillespie Williams. 2nd Edition. Pp. 198, 77 illustrations including six colour plates. Published by Sir Isaac Pitman & Sons Ltd., London, 1958. Price 35s.

A second edition of a book suggests that it has already been well received. A second edition of two books on the same subject, issued by the same publisher, suggests not only a lively interest in the subject, but that both authors have found a responsive public.

A Foreword to Mr. Williams's book makes the point that both theory and practice are necessary if one is to understand; and both volumes show appreciation of this important fact. Mr. Williams tackles his subject in perhaps the more orthodox manner by starting with the theory and showing how it is applied in practice. Mr. Corry plunges us immediately into a lively consideration of practical problems, but shows all the way through how his practice arises from theoretical considerations. This difference in approach is well exemplified by the titles of the first few chapters. For Mr. Williams they are: Vision and Colour; Control and Measurement of Illumination; Light Sources and Colour Filters. From Mr. Corry we have: The Producer's Responsibility; Why Lighting is Important; What Must be Lighted.

It is obvious that both these books will be of value to those interested in the theatre, and this includes not only the amateur, who has an insatiable curiosity about the subject, but also the spectator, who would often gain a great deal if he knew something about how the wheels were turned. It may well be, too, that the professional man of the theatre could profit from reading these excellent books. But one commends them also to the lighting engineer even though he has little interest in the theatre as such. For so many of the artistic effects achieved on a stage are those which we are now beginning to realise should be used in more ordinary lighting design. The careful juxtaposition of colours, the skilful use of light and shade, and the dramatic effect of shadows, are gradually replacing the "flat, stale and unprofitable" laying-on of light, which is so often regarded as good lighting. The problem is, of course, much more difficult for the designer of a practical interior than it is for the stage lighting engineer whose work is only viewed through a window, but there is much to be learned by understanding stage lighting technique.

Mr. Corry and Mr. Williams develop their themes each in his own way, both interestingly, and although there are differences in ideas between them, these are in general not the result of fundamental differences, but of differences in viewpoint. As Mr. Tyrone Guthrie says in his preface to "Lighting the Stage": "It is my belief that there is no single Right Way to do anything; or even to think of anything."

Therefore, one should read both of these books. There is a strong possibility that one will want to keep one or the other or both of them.

W. R. S.

POSTSCRIPT By 'Lumeritas'

IT IS probably quite safe to say that no interior to which the general public has access has ever been equipped with lighting which has won the unqualified approbation of everyone who has seen the installation and its effects. The ideal does not exist and never will, though there is just a chance that my ideal or yours is to be found somewhere or, if not, that both of them may be realized before either of us ceases to be an idealist—or just ceases to be. Fortunately, most of us are reasonable creatures and are content to settle for something that falls short of our ideal. But the difficulty remains that what is acceptable to Tom as a reasonable approximation to his ideal is often far from approximating to the ideals of either Dick or Harry. This difficulty seems always greatest when the lighting in question is that of an interior designed in a period when candles were practically the only artificial light sources.

At present there is controversy about the lighting of the sanctuary in St. Paul's Cathedral. The new high altar—which is beautiful and characteristically Wrenish in style—has on either side of it a large glass chandelier, and two more of these chandeliers are hung behind the altar and can be seen through the altar arch. This has aroused the wrath of a writer to the editor of a national daily paper. "Ballroom chandeliers" he calls them. True enough; but they are not necessarily out of character in a cathedral because they are in character with certain ballrooms. It all depends on the style of the cathedral, and, having seen these chandeliers in St. Paul's, I do not consider them at all incongruous in their present situation. In fact, I think they heighten the magnificence of the sanctuary without being garish and without appearing to be foreign to their setting. Such chandeliers were unknown in Wren's time; they made their appearance about 100 years later. This is another objection raised against them, "they are out of period." So what? All electric lighting is out of period in such a building, although the luminaires in the choir stalls—which are electric "candles" equipped with red shades—are as much in period as anything but tallow candles can be. However, unless one knew that glass chandeliers came after Wren, the "out of period" objection could not arise. The only question that need be asked is, are these luminaires out of style? To my way of thinking, they are not, and, had they been available, Wren may well have used them in this great church. I believe they are only on trial at present, and that a small minority of the Chapter object to them. I hope the minority remains small.

WRITING of window-shopping, the women's fashions columnist of an evening newspaper has been criticising the lighting of the windows of many London shops and stores. "Compared with the bright and clever effects in shops in New York and Chicago" she finds "too many London windows dim and rather drab, particularly on a rainy day." To car showrooms and fur shops she gives the lowest marks and comments that the products displayed in these need plenty of light and sparkle to show them at their best. She admits that London shop windows have improved enormously in the last few years and, in this respect, Regent Street is "one of the most attractive shopping streets in London. But before we can say it is as good as any in the world, shopkeepers must get down to their lighting problems. The woman window-shopper is a moth-like creature. She is automatically drawn towards the temptation of blazing lights." I am sure that this writer did not mean to advocate visible "blazing lights," but, rather, the brilliant window-lighting that such lights can give while they themselves are discreetly screened from the window-gazer's view. Bare blazing lights in shop windows are not as rare as they should be, and the window-shopper will find them in New York and other places as well as in London.

WHILE the last issue of this journal was going through the press with its editorial "Lighting and Seeing"—pleading for closer co-operation between opticians and lighting specialists—*The Optician* appeared with an editorial entitled "Sight and Light." This also pointed to the need for mutual recognition by these two kinds of specialists of the part each must play in helping people to see properly. I am assured that this was not due to any collusion although, had it been, collusion for this purpose would have been quite laudable. The points made by *The Optician* are worth repeating here. Firstly, as the age of the eyes advances more light is needed for seeing "close work" efficiently and comfortably, and/or optical correction for presbyopia ("old sight") is needed. Secondly, to a certain extent, boosting the working illumination may be equivalent to a lenticular correction, or it may compensate for some inadequacy of such a correction, at least for a time. However, there is sometimes serious difficulty in getting sufficient light to the work itself, and although there have been spectacular improvements in artificial lighting during recent years, there are many installations which do not provide optimal seeing conditions if artificial lighting has to be used for long periods and which are not capable of meeting all individual needs. So, lenticular aids to seeing are needed not only when the lighting is poor but, by some people, when it is reckoned as good. "Improved lighting is one way to ease the load on human vision. Improved prescribing is another. . . ." And improved prescribing includes the prescribing of more "special purpose glasses." This is very true. The ophthalmic optician and the lighting engineer are complementary: the skill of both needs often to be exercised together so as to make seeing as good and easy as possible.

THIS month's snippet. A Birmingham engineering firm have handed to the Birmingham branch of Siemens Edison Swan Ltd. a 60-watt Brittania lamp which they bought 30 years ago. This lamp, which was made by Siemens, is still in good working order. SES still market a lamp of similar type—squirrel cage vacuum—the original being that specified by the BOT for mast-head lighting on ships where reliability is essential.

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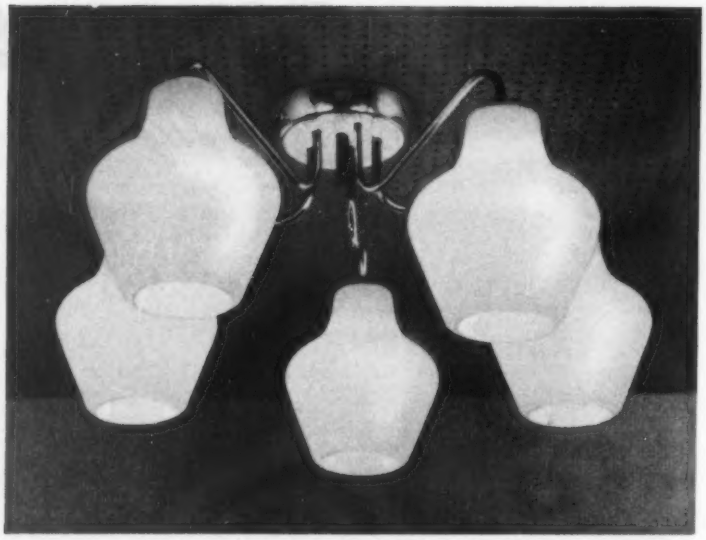

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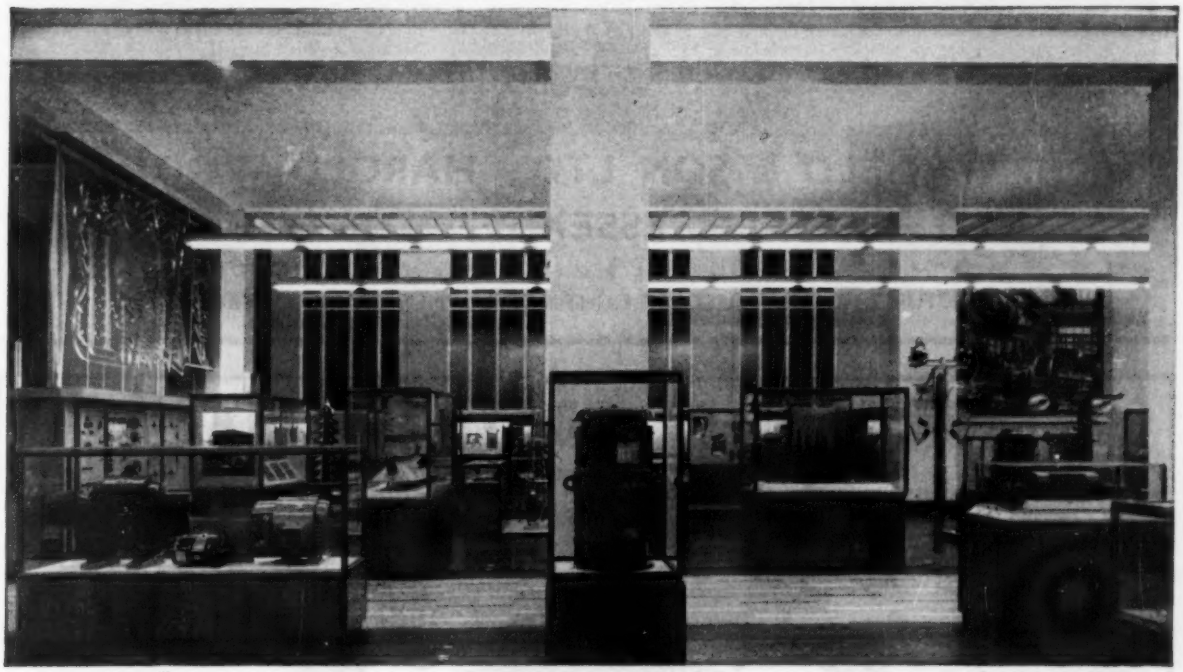

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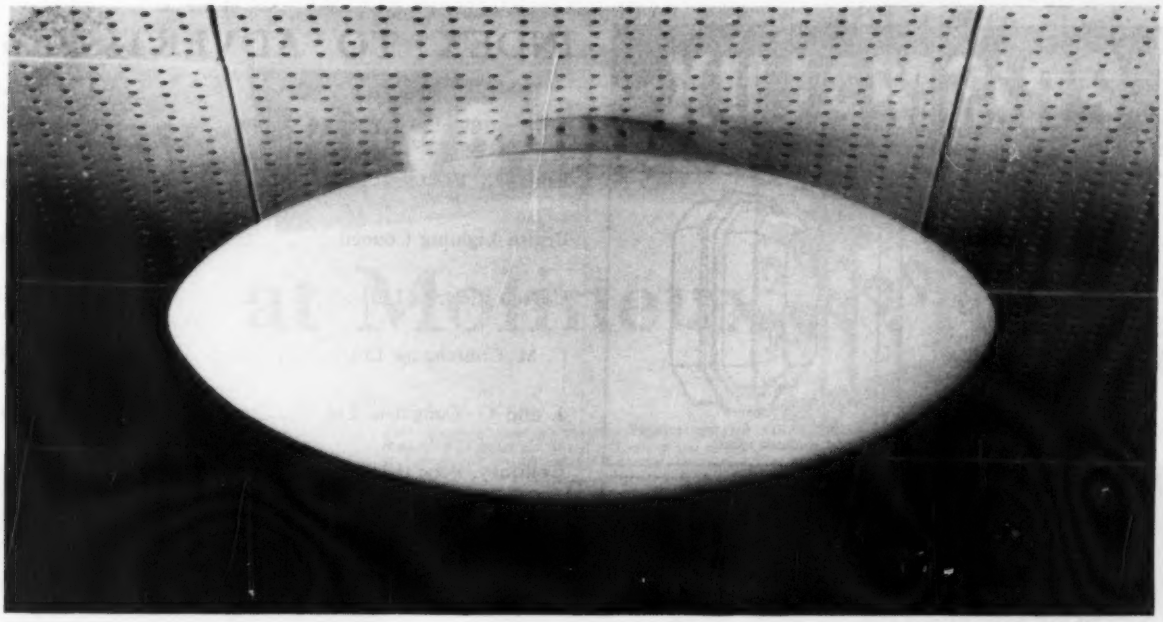

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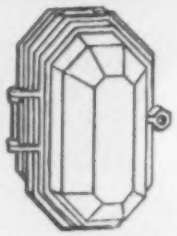

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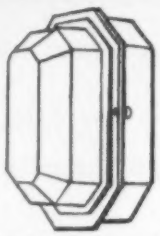

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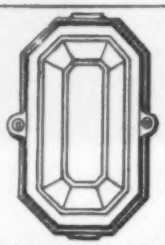

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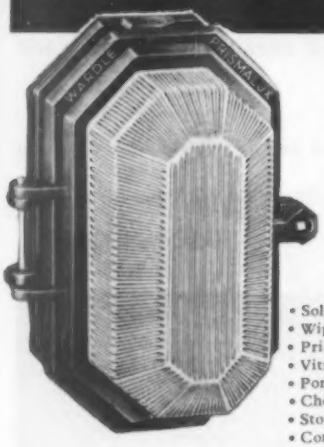

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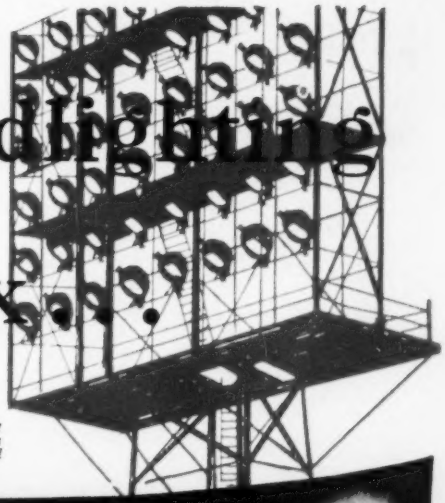
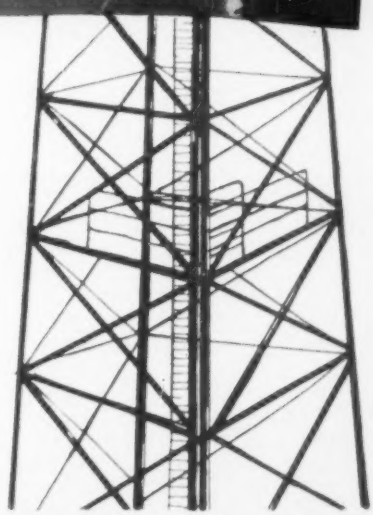
Published by THE ILLUMINATING ENGINEERING PUBLISHING COMPANY LIMITED, at 32 Victoria Street, London, S.W.1. Printed by ARGUS PRESS LIMITED, Temple Avenue, and Tudor Street, London, E.C.4, England.

New REVO floodlighting at Molineux . . .



This action photograph showing Wolves playing Real Madrid under the new floodlighting was taken at 1/50 sec. at an aperture of f.11—i.e., a normal daylight exposure.



After exacting tests with floodlights of varied makes, Revo equipment was chosen to provide Wolverhampton with the finest football-ground floodlighting system in the country.

The four 146 ft. towers each support 48 Revo floodlights fitted with silvered-mirror reflectors and using Tungsten Filament Lamps, giving a total floodlighting load of 330 Kw. Facilities have been provided to increase the number of floodlights per tower to 60, giving a total load of 415 Kw.

Revo equipment has been specified for some of the most important installations of public and industrial lighting throughout the world, and the Wolverhampton Wanderers Football Club scheme is yet another example testifying to the high quality and efficiency of Revo products.

REVO ELECTRIC COMPANY LTD., TIPTON, STAFFS.

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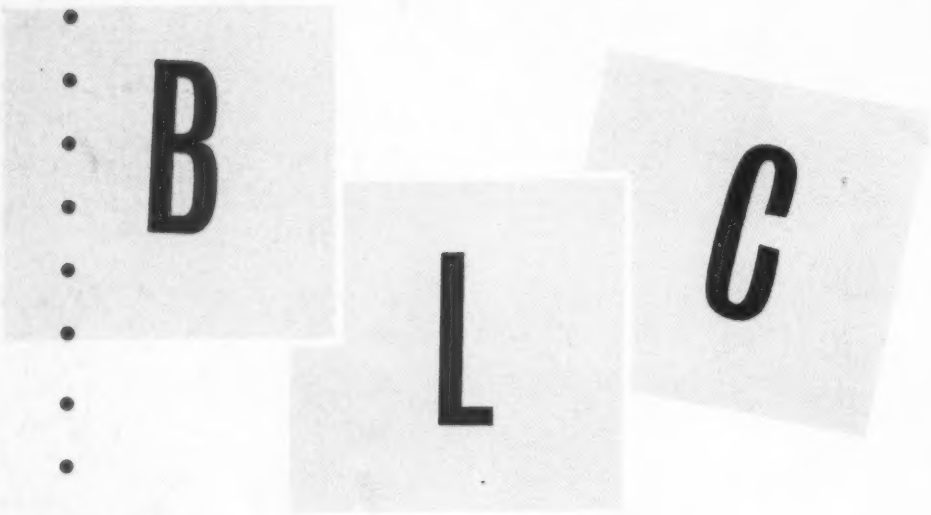

expanding the market

Few of Britain's millions of light users are taking maximum advantage of the excellent products of the British lighting industry because lighting equipment, however good in performance and design, is seldom fully appreciated unless those using it are acquainted with its potentialities.

To make these potentialities better known, the British Lighting Council, both in London and through its regional offices, organises courses and conferences covering almost every lighting application.

Its lecturers are expert at explaining what may be a complicated story in a simple and appropriate way whatever the type of audience. Through the work of the Council the public is speedily given knowledge of the products of B.L.C. members who represent all that is best in British lighting.

The British Lighting Council, 2 Savoy Hill, London, W.C.2

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